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**Endo et al.**

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(54) **BOARD CONNECTOR**

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(71) Applicant: **DAI-ICHI SEIKO CO., LTD.**,  
Kyoto-shi, Kyoto (JP)  
(72) Inventors: **Takayoshi Endo**, Shizuoka (JP); **Yudai**  
**Baba**, Shizuoka (JP)

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(73) Assignee: **DAI-ICHI SEIKO CO., LTD.**,  
Kyoto-Shi, Kyoto (JP)

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*Primary Examiner* — Truc Nguyen  
(74) *Attorney, Agent, or Firm* — Howard & Howard  
Attorneys PLLC

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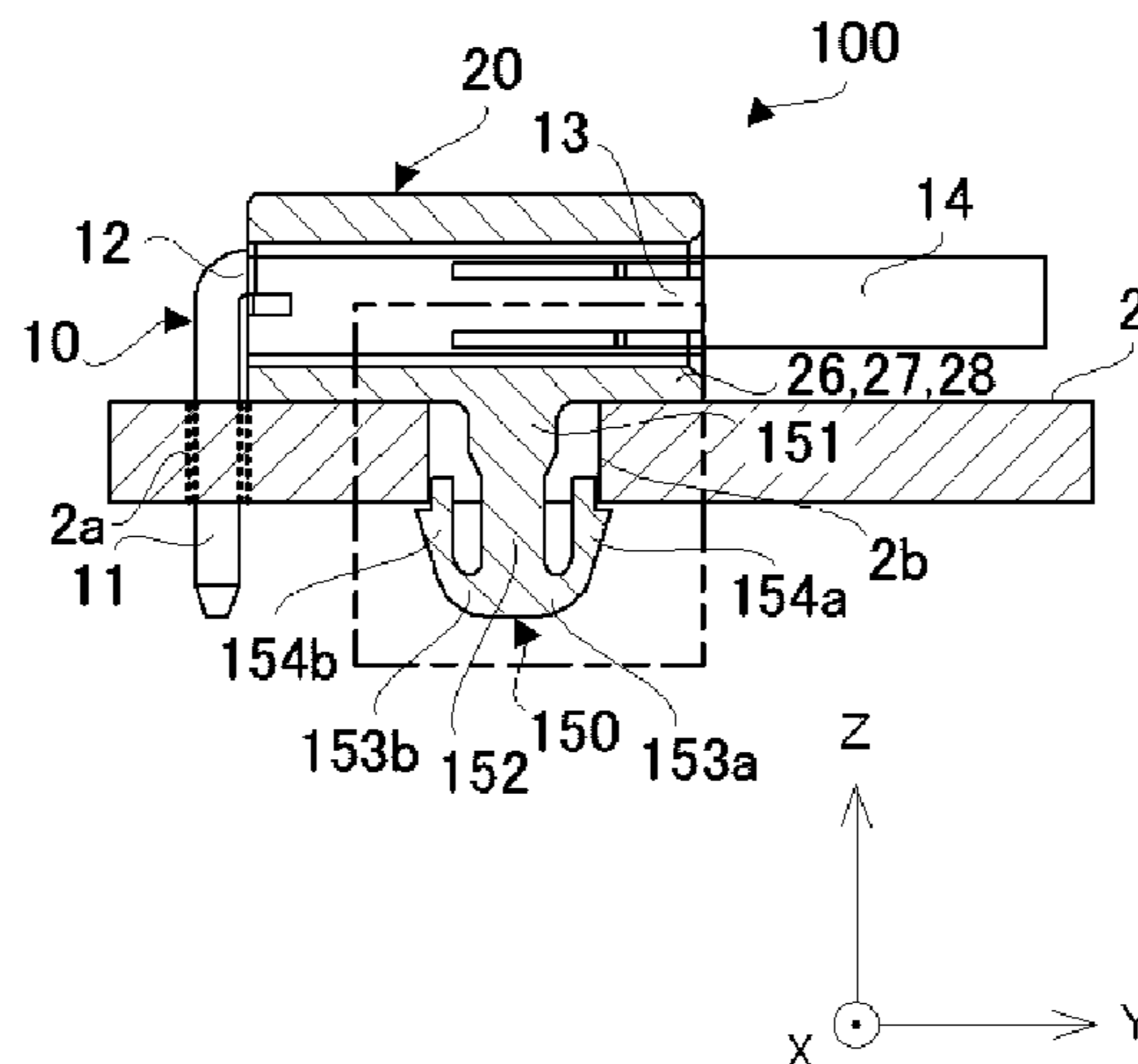
(57) **ABSTRACT**

(51) **Int. Cl.**  
**H01R 12/75** (2011.01)  
**H01R 12/51** (2011.01)  
(Continued)  
(52) **U.S. Cl.**  
CPC ..... **H01R 12/51** (2013.01); **H01R 12/7011**  
(2013.01); **H01R 12/7023** (2013.01); **H01R**  
**13/46** (2013.01); **H01R 12/75** (2013.01)

A board connector includes: an L-shaped pin terminal including an insertion inserted into a through hole in a printed board and a conductor swaging part extending in a direction (+Y-axis direction) orthogonal to the insertion; and a housing disposed on one main surface (flat face on the +Z side) of the printed board, the housing containing at least an end of the conductor swaging part and having an opening into which a cable connected to the conductor swaging part is inserted. The board connector further includes a J-shaped boss formed integrally with the housing, the boss passing through a through hole in the printed board and protruding from another main surface (flat face on the -Z side) of the printed board, extending in a direction (D2) (the +Y-axis direction) opposite to a direction toward the insertion, and further extending toward the printed board.

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CPC ..... H01R 12/005; H01R 12/721; H01R  
13/506; H01R 13/6275; H01R 12/724;  
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**6 Claims, 21 Drawing Sheets**



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FIG. 1

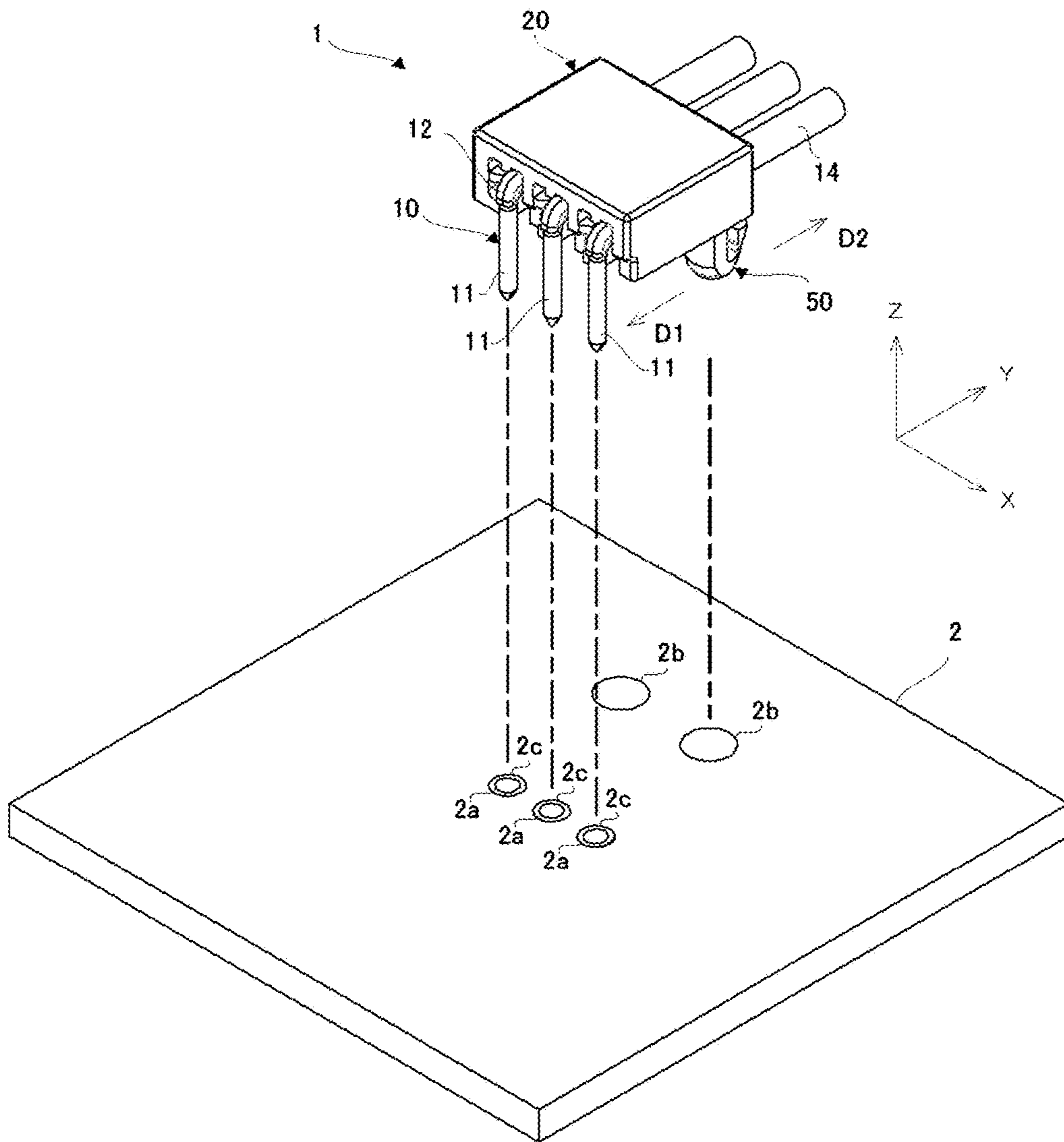


FIG. 2

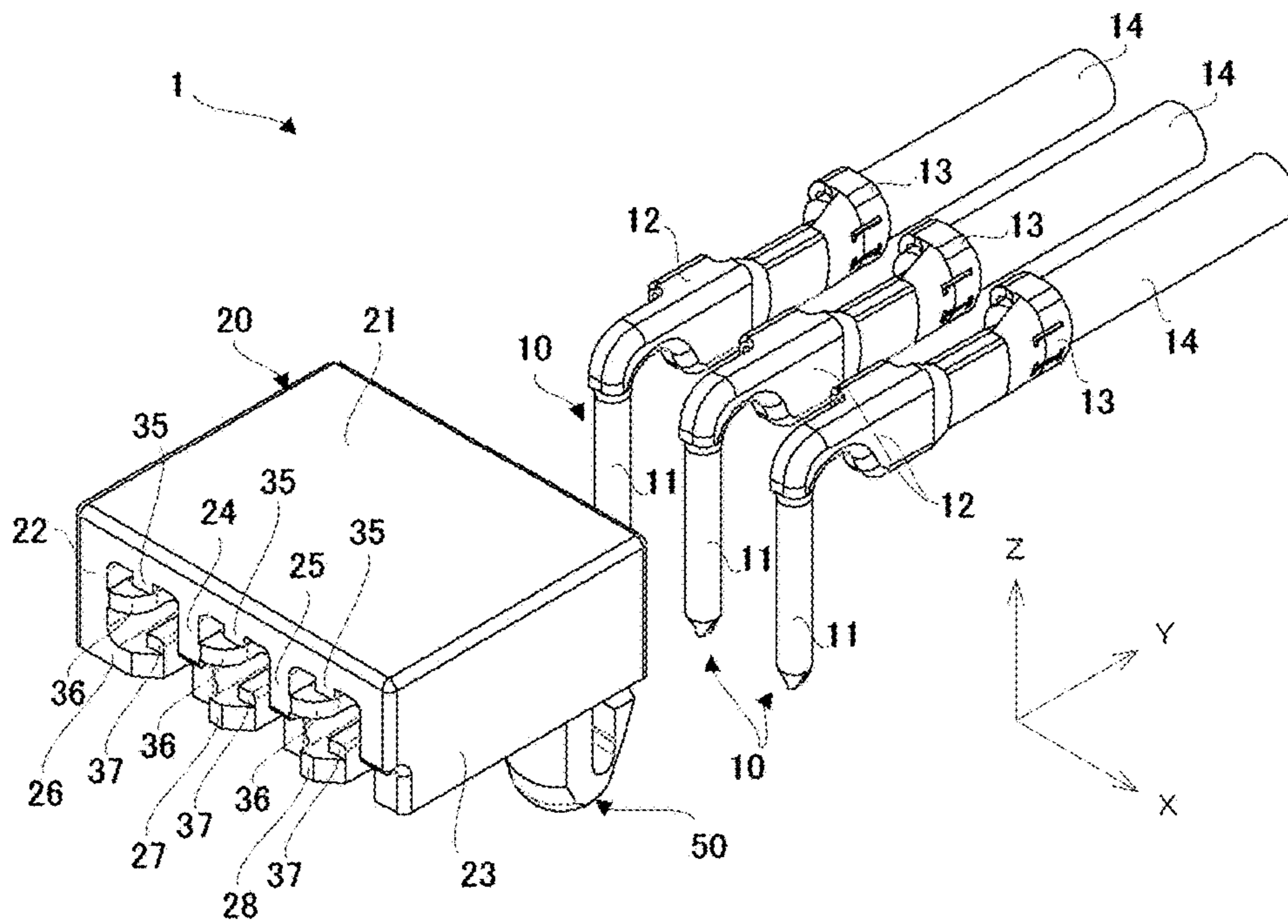


FIG. 3

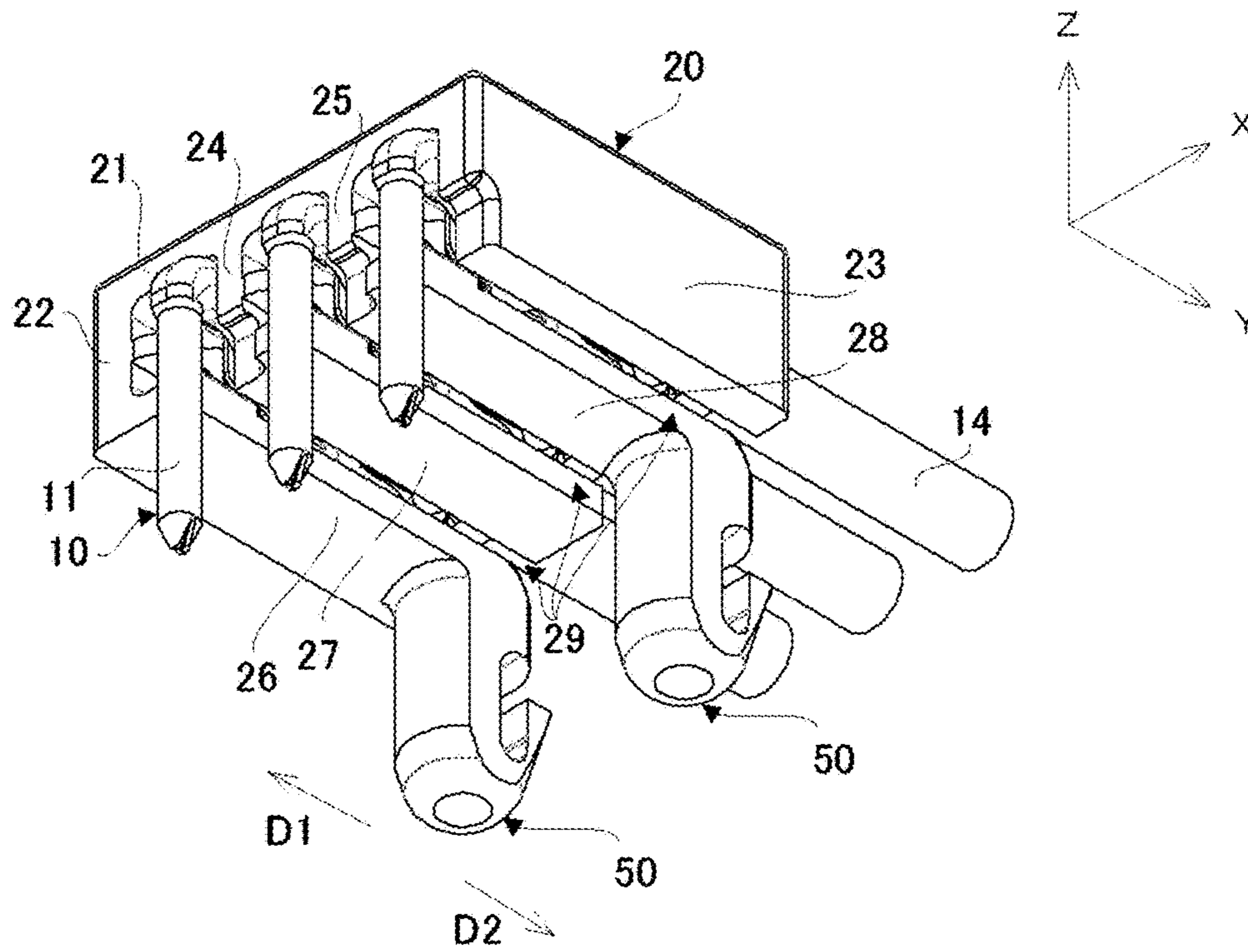


FIG. 4

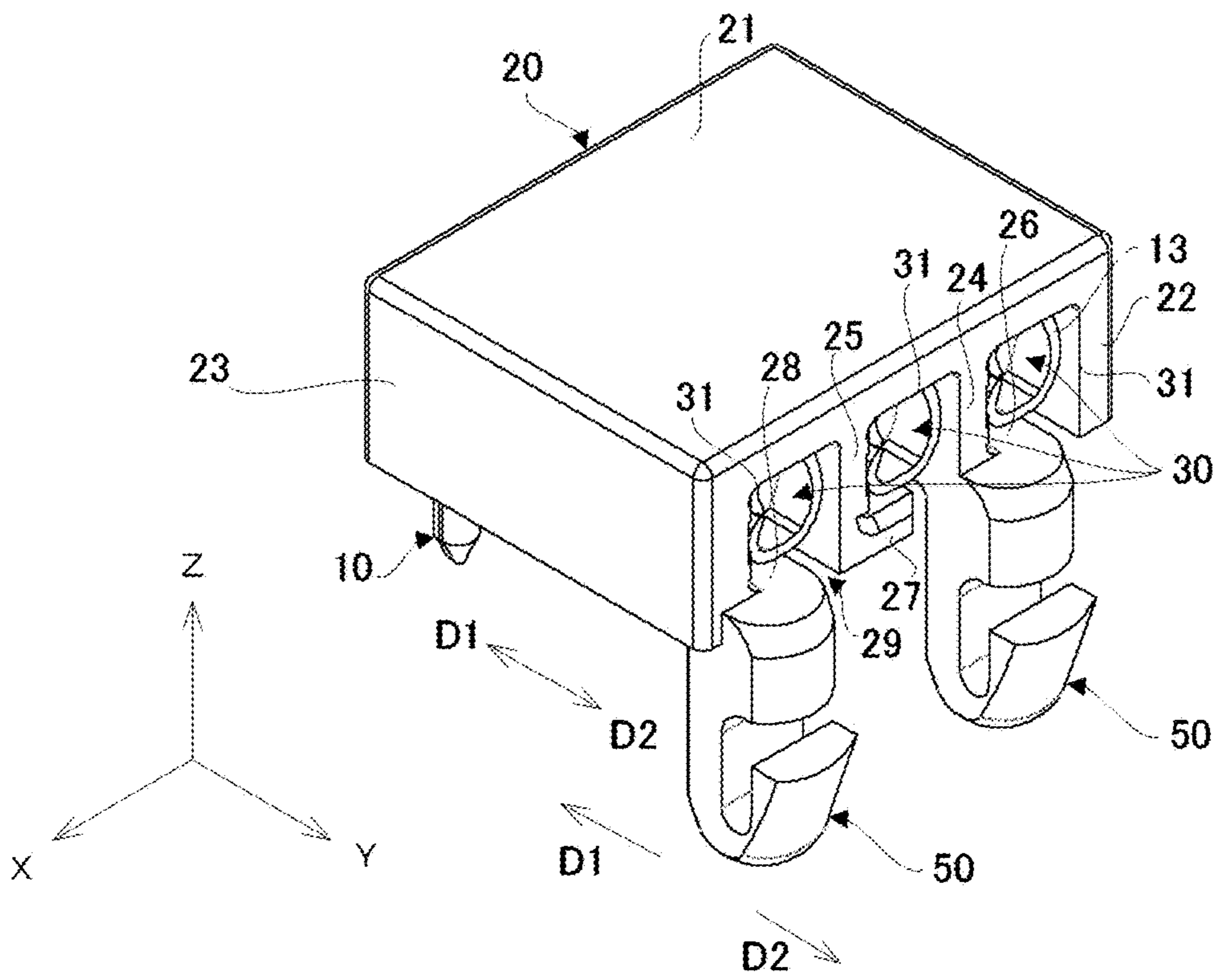


FIG. 5

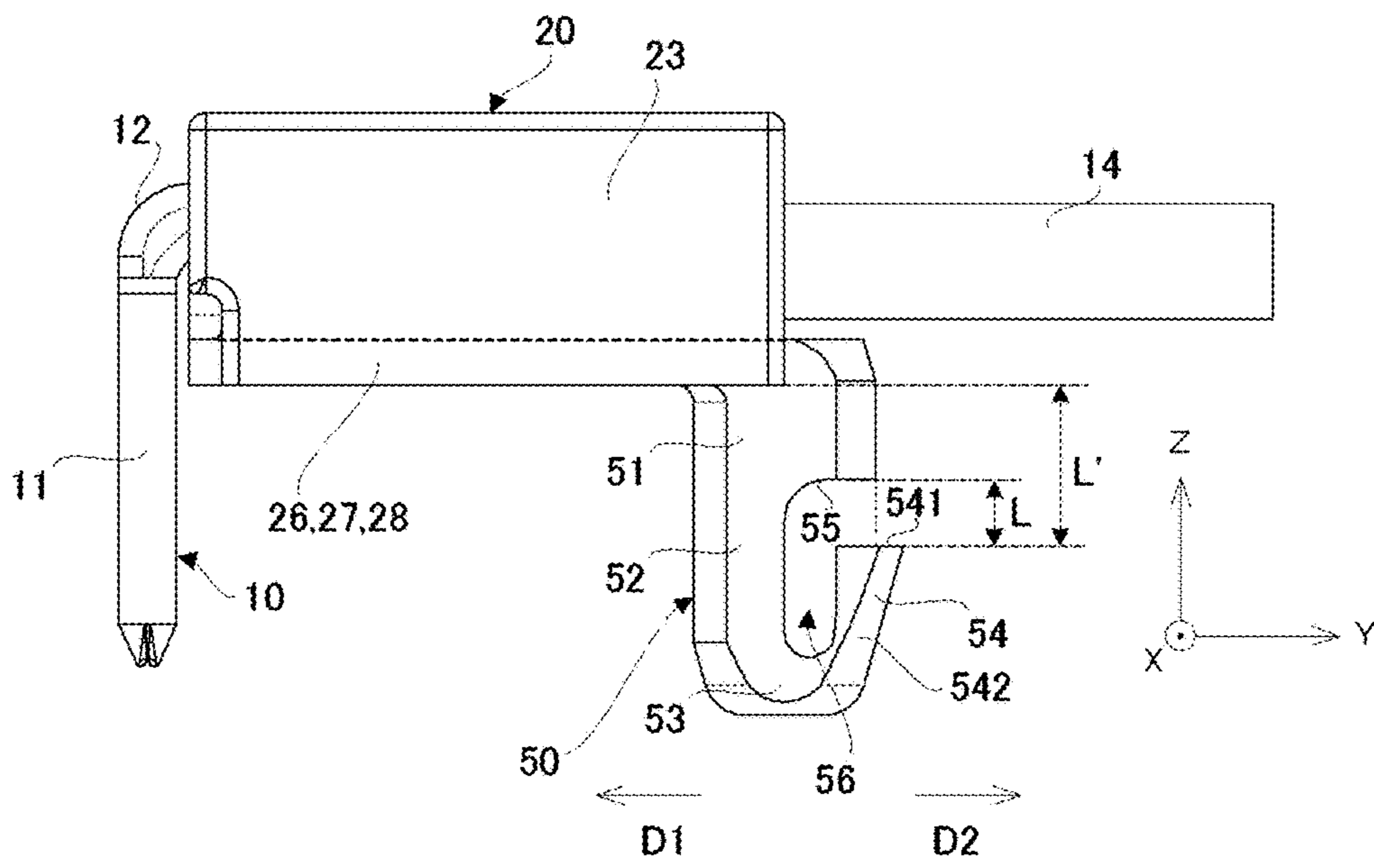


FIG. 6A

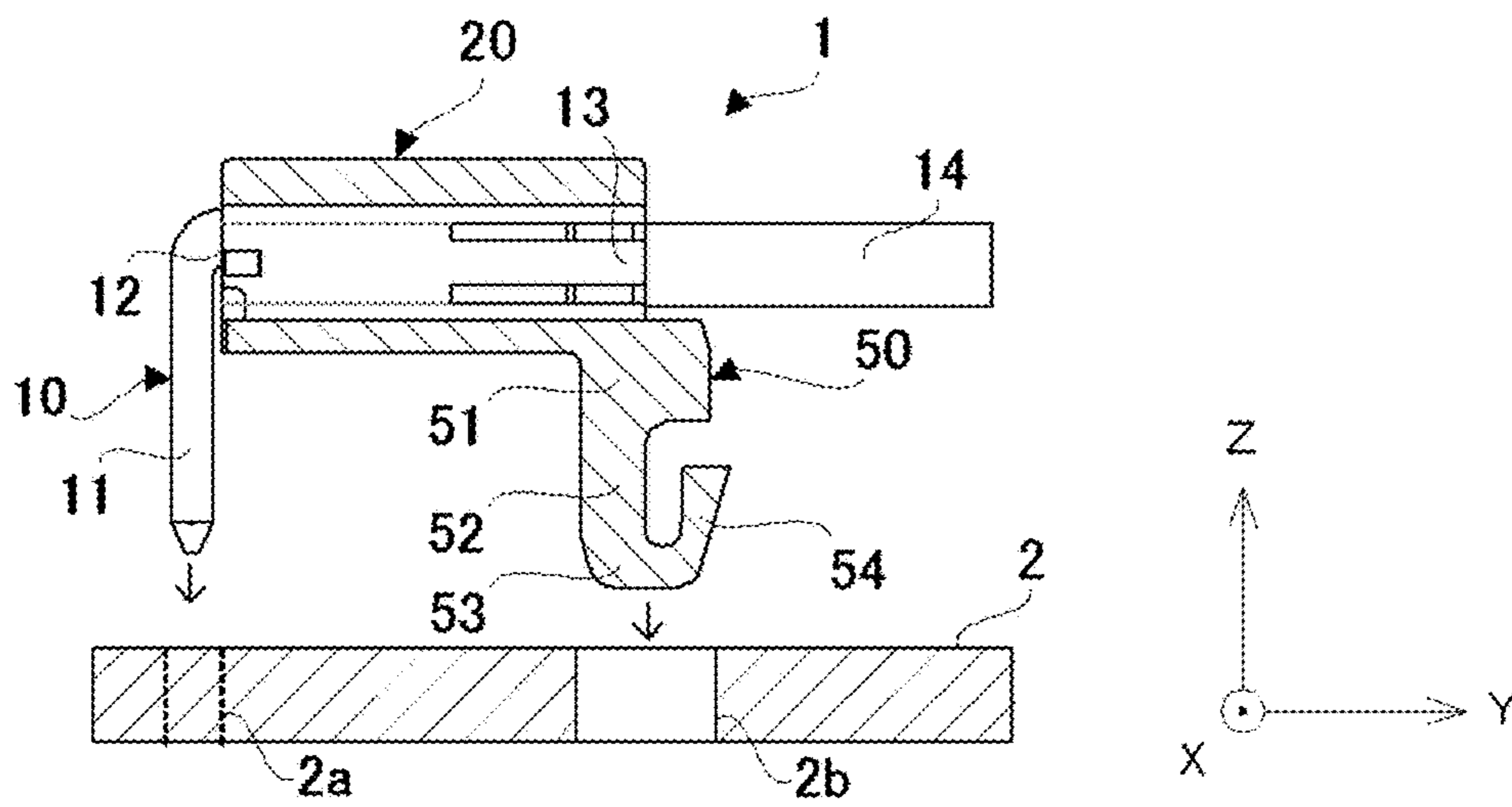




FIG. 6B

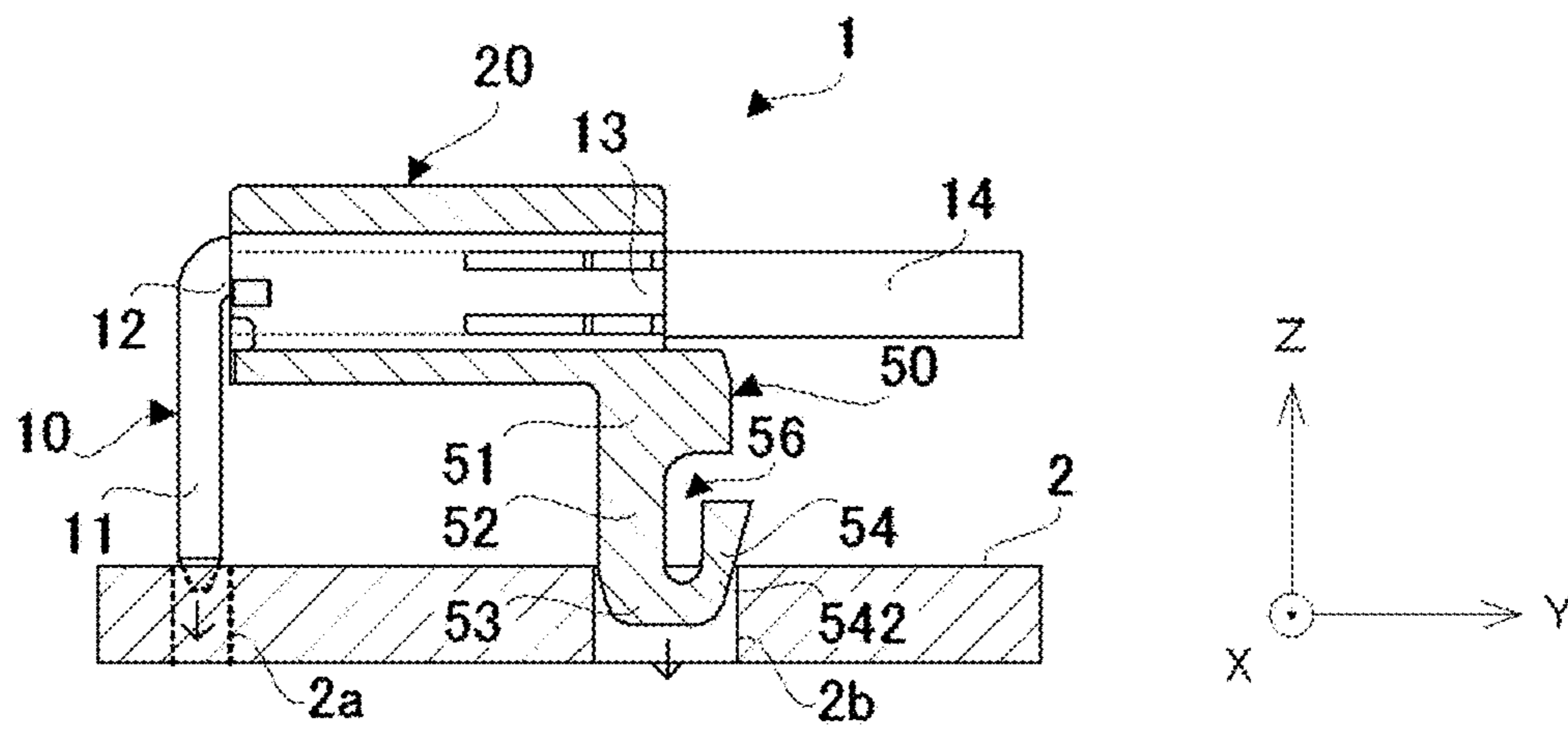


FIG. 6C

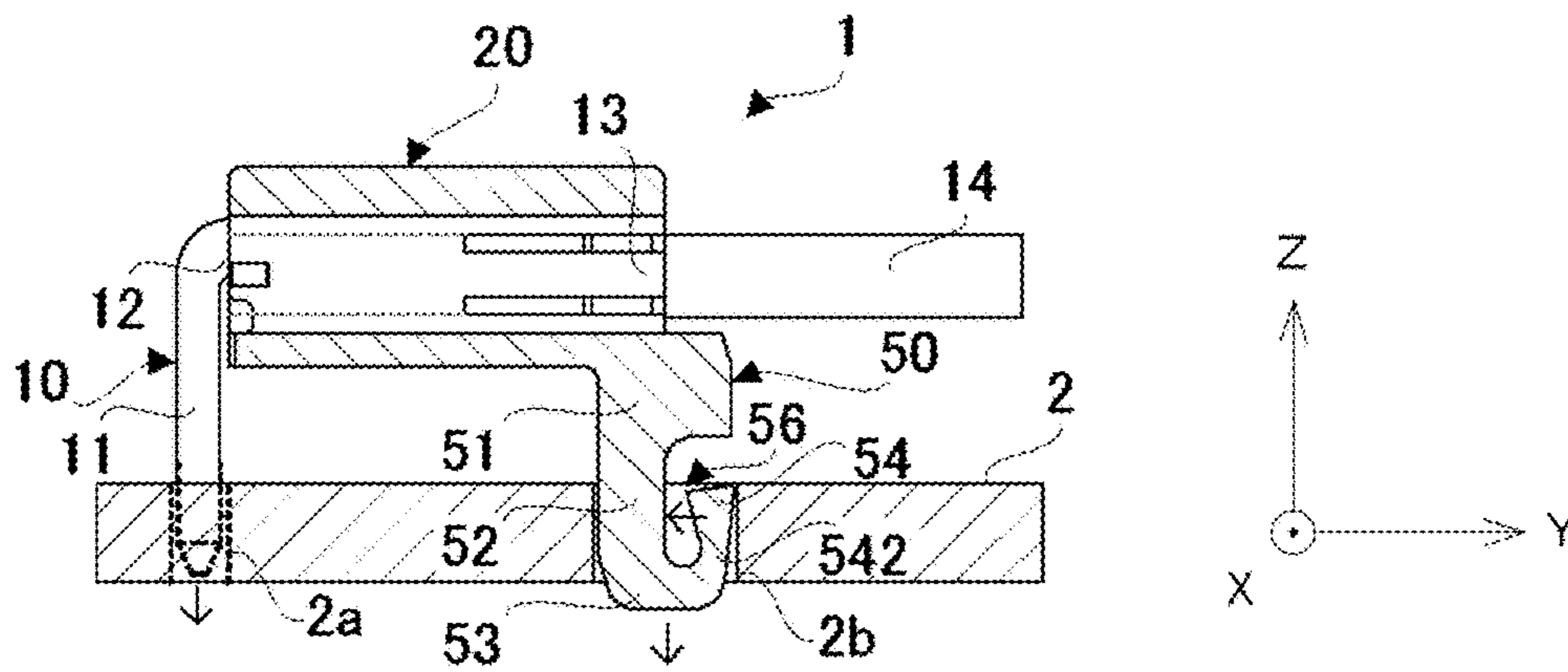


FIG. 6D

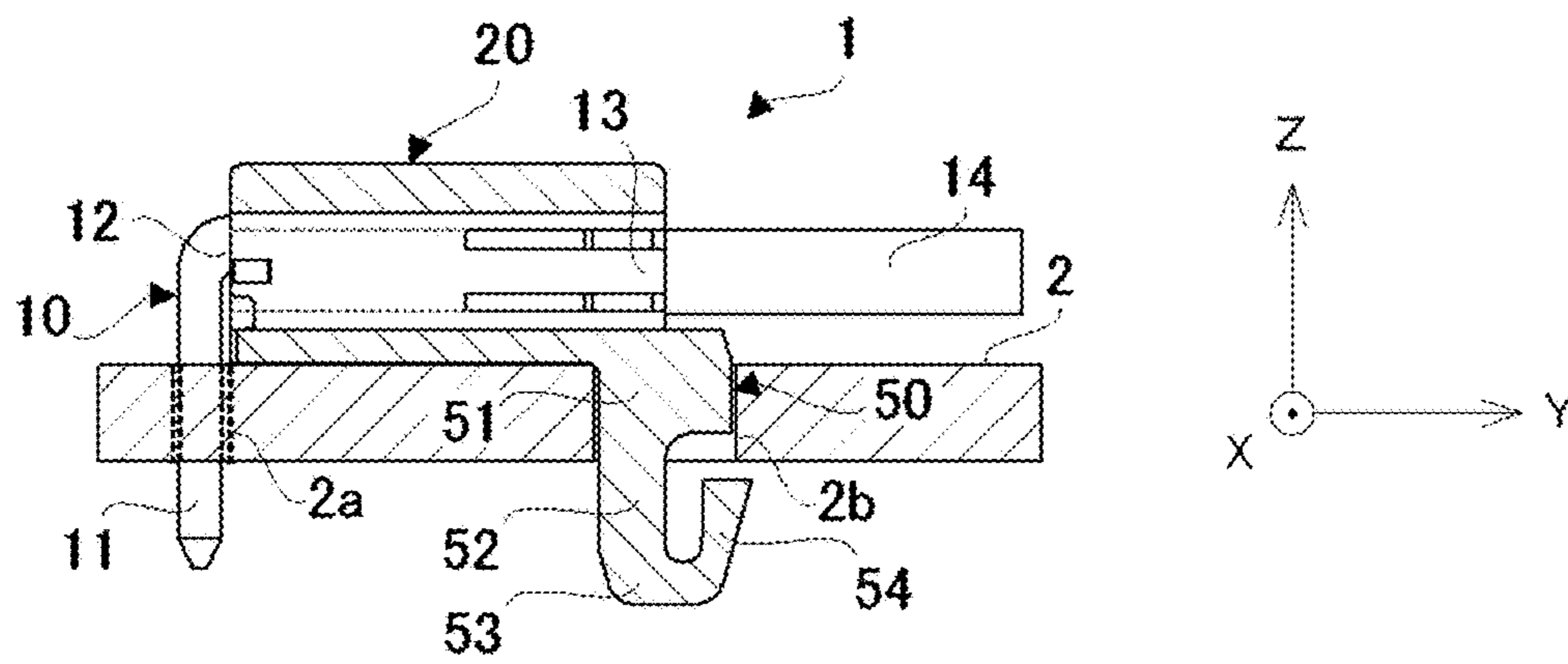


FIG. 7A1

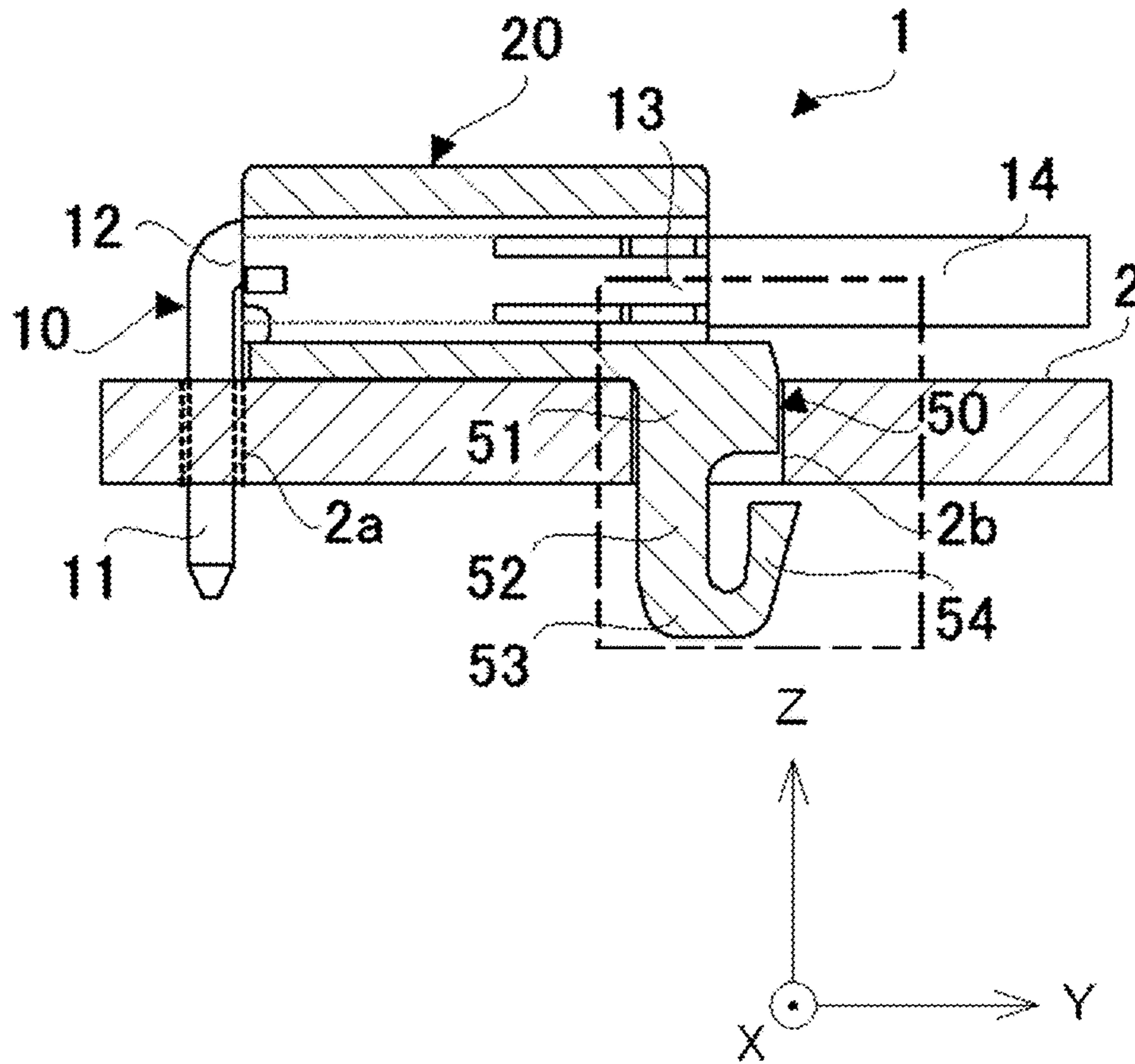


FIG. 7A2

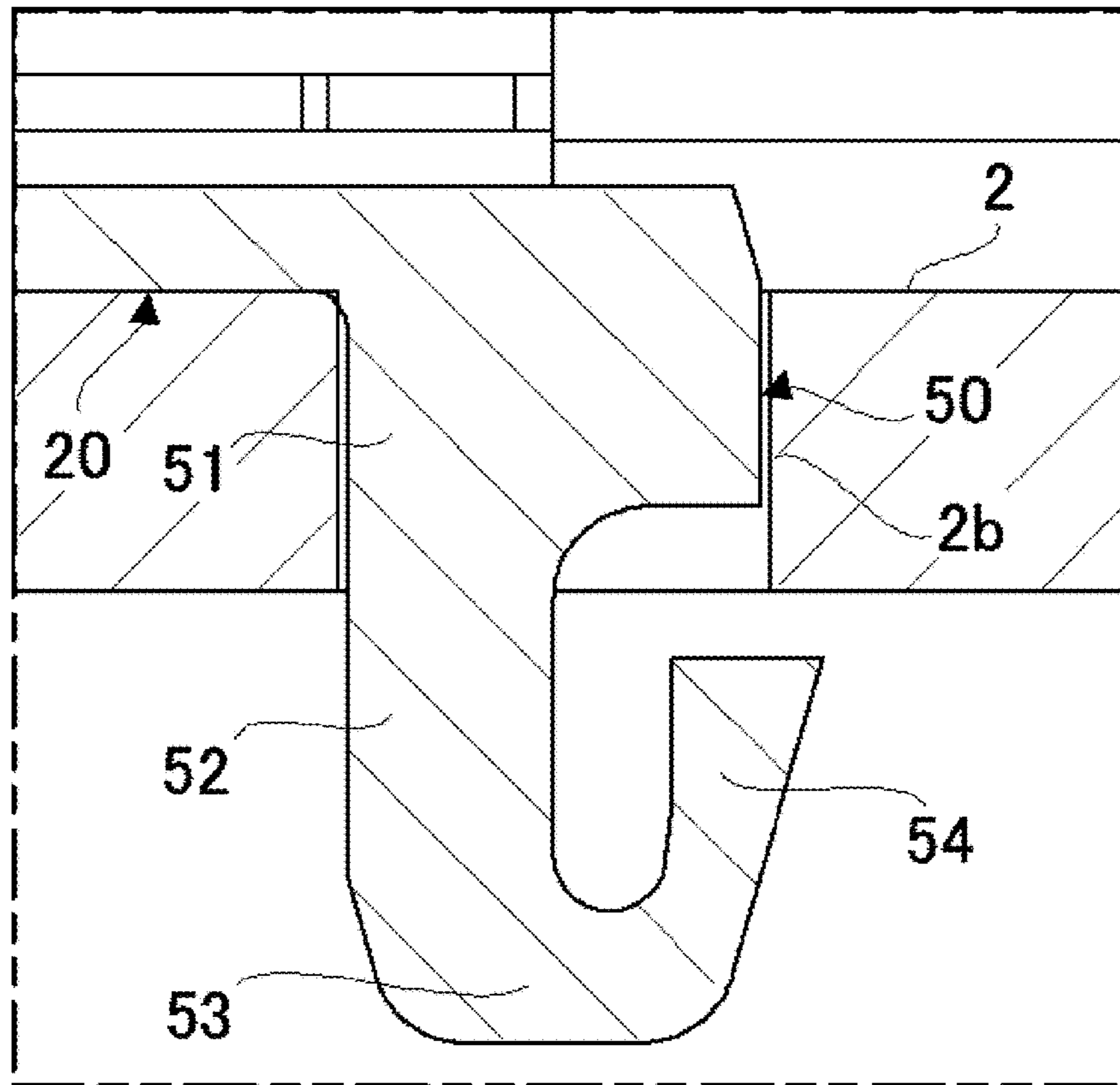




FIG. 7B2

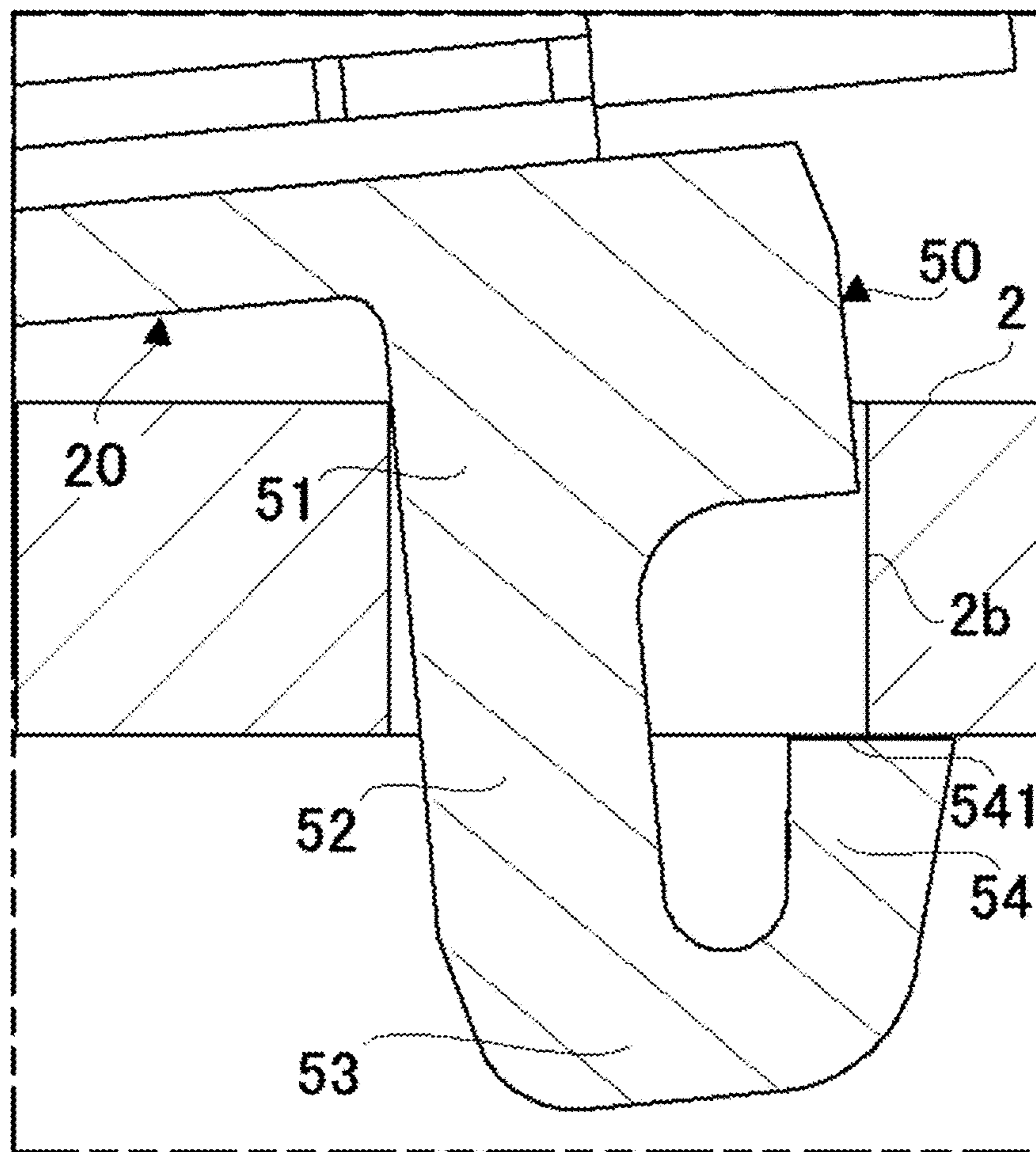


FIG. 8A1

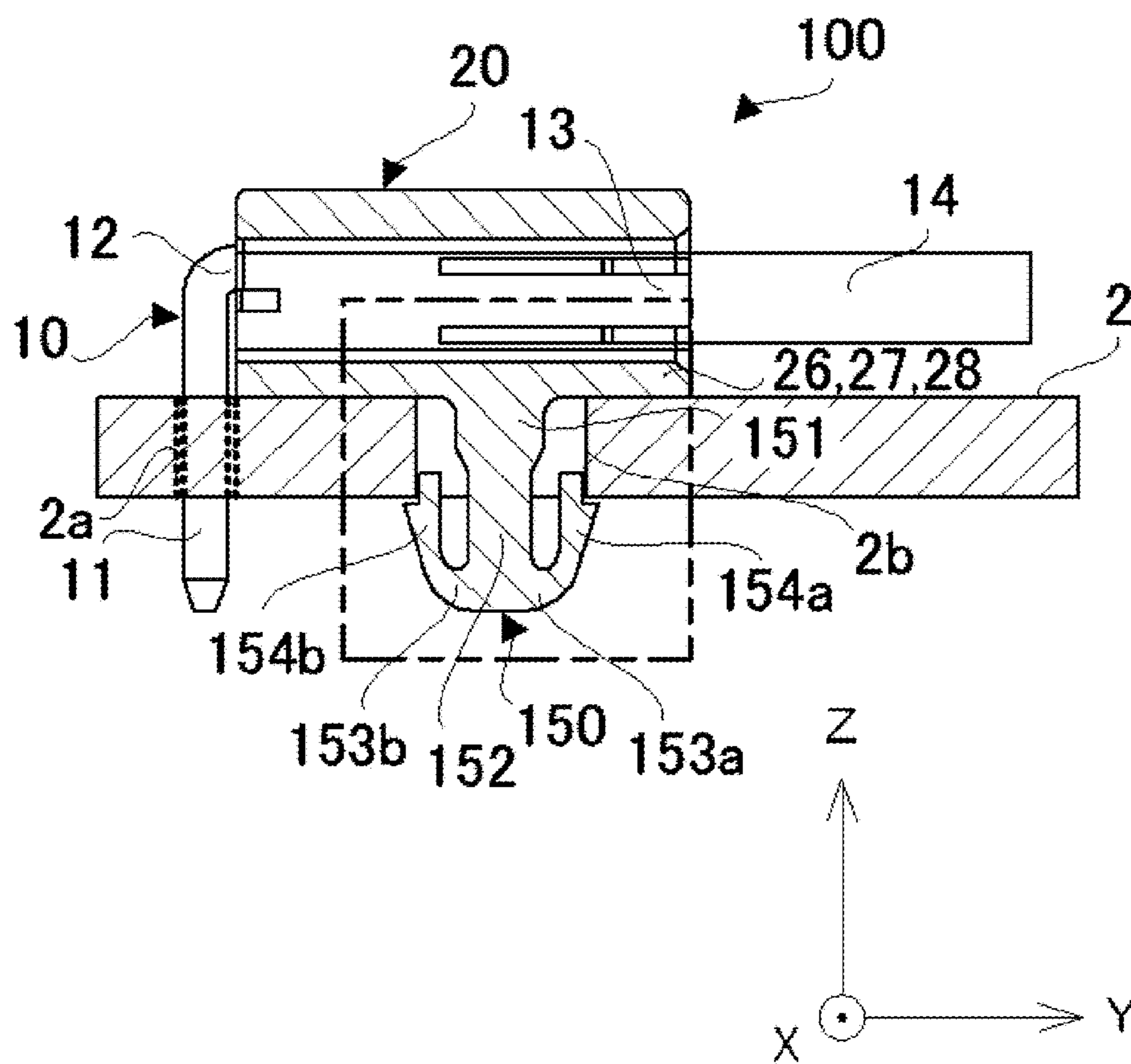




FIG. 8A2

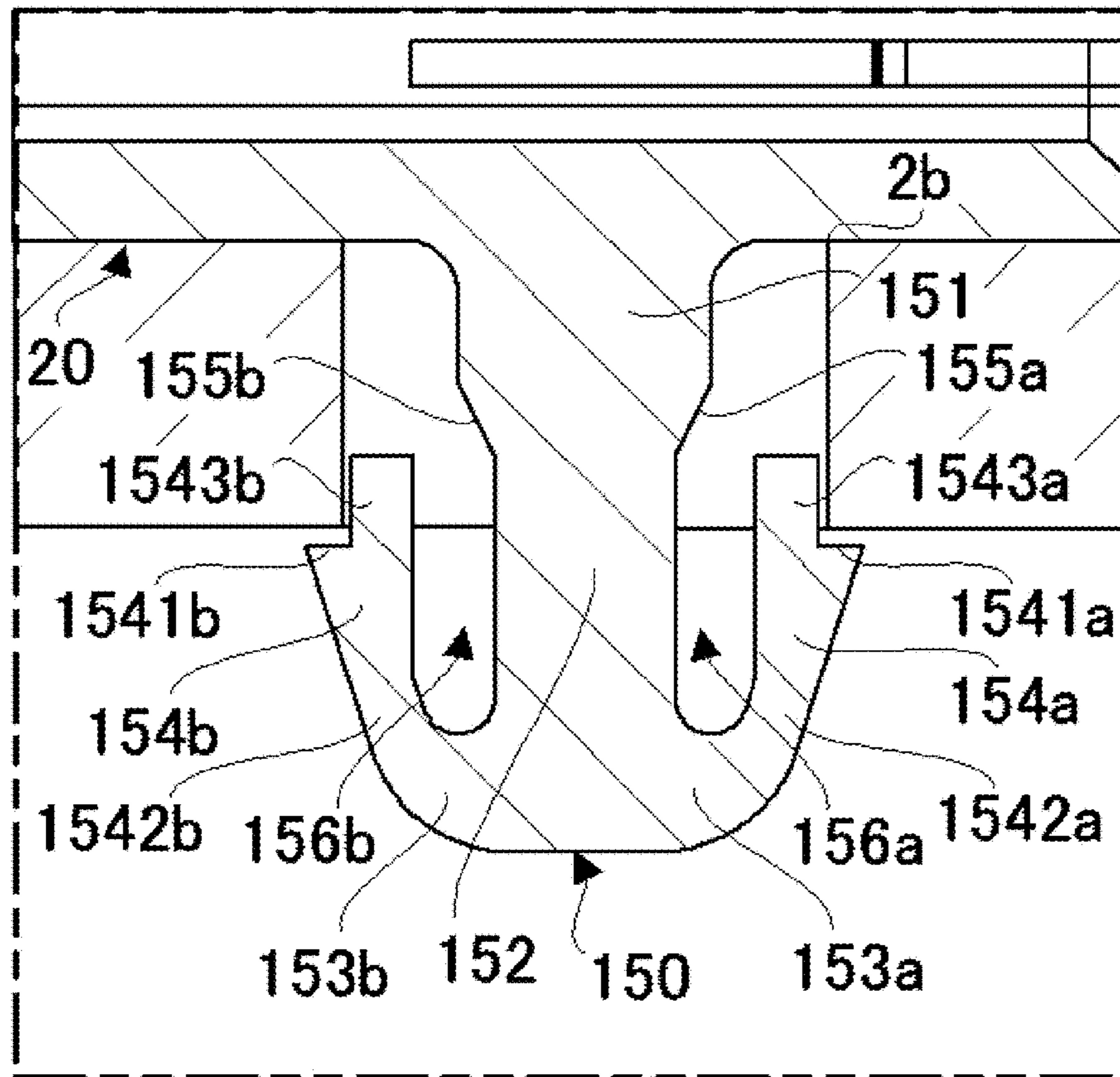


FIG. 8B1

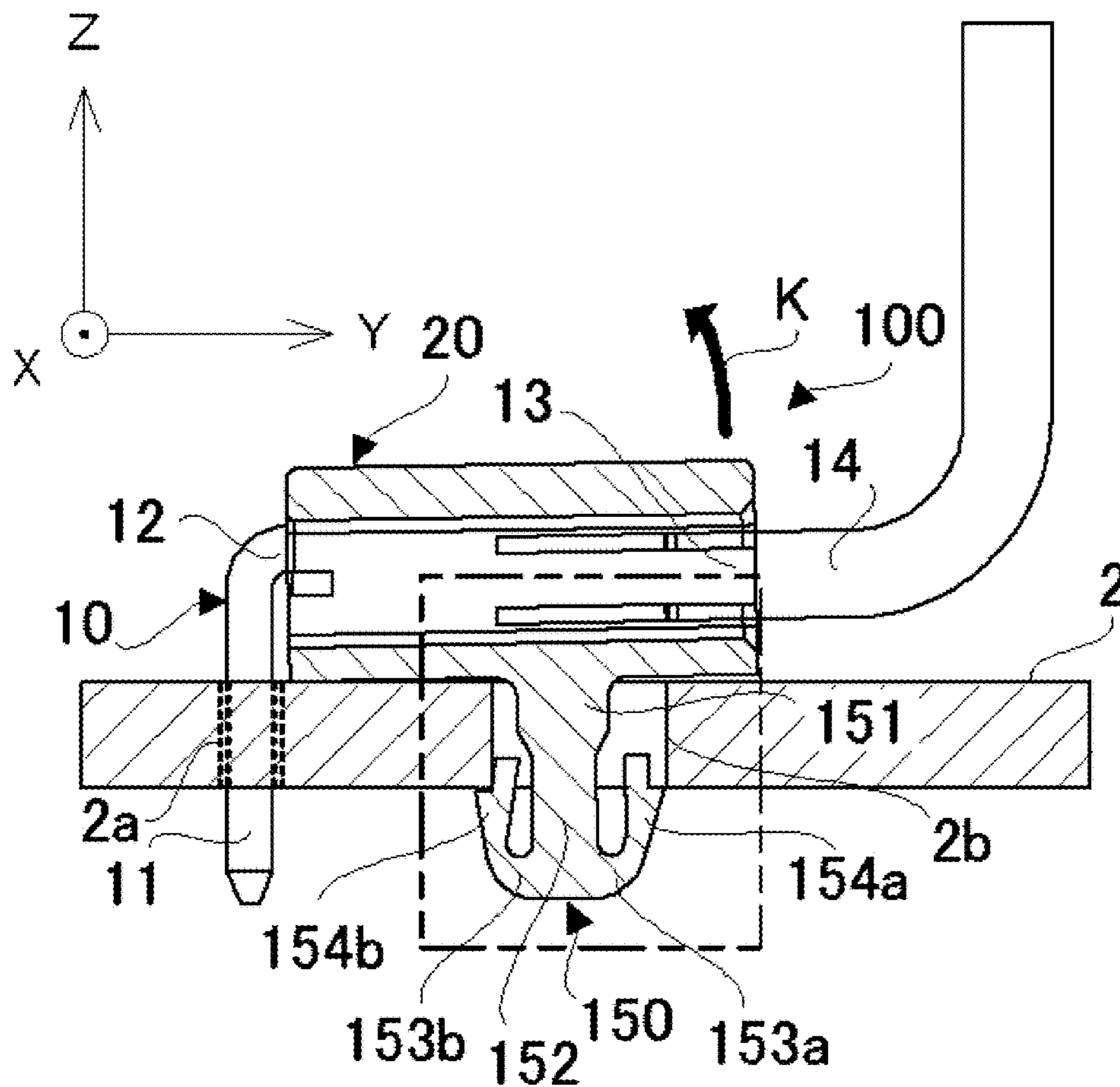


FIG. 8B2

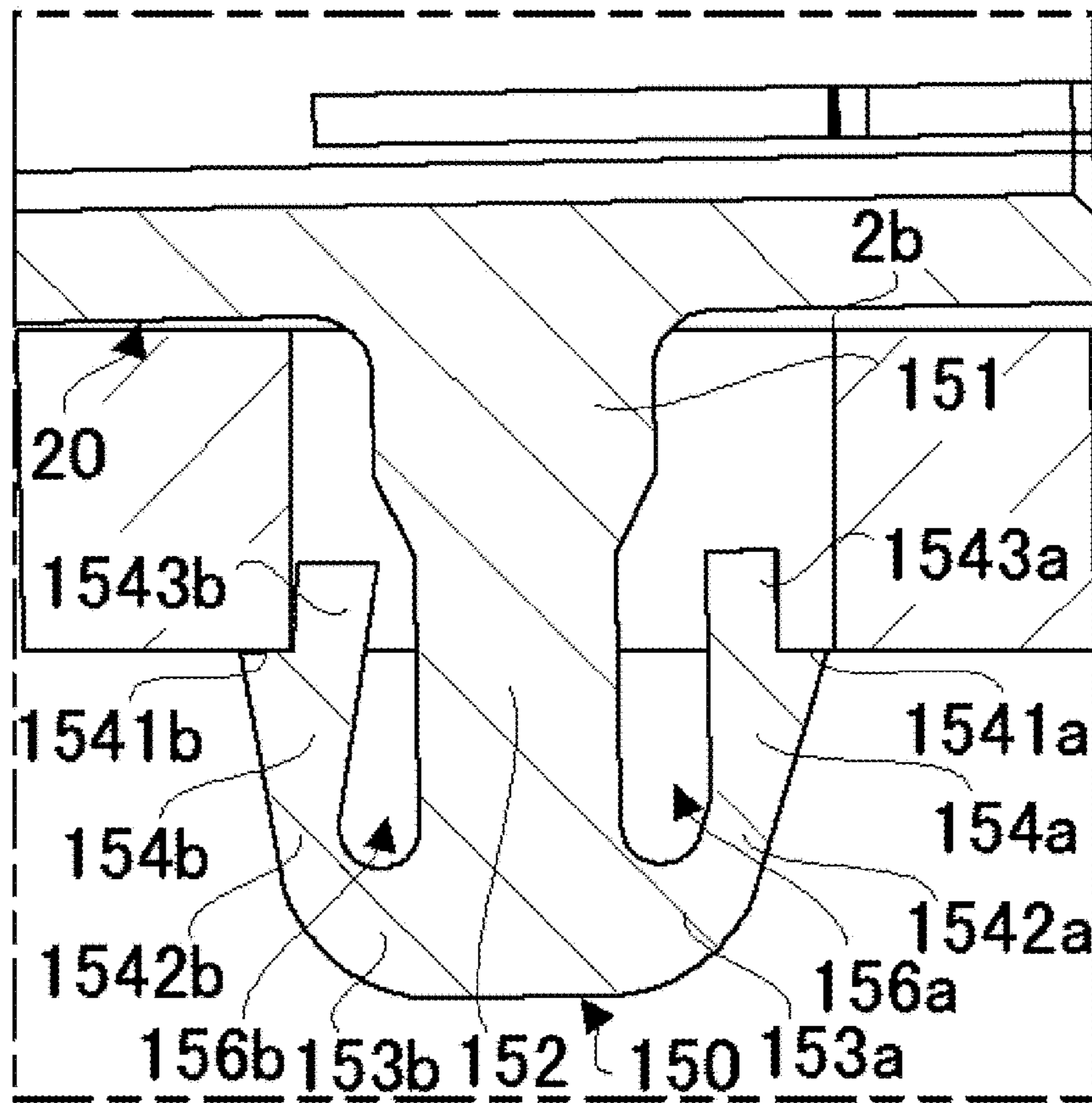


FIG. 9A1

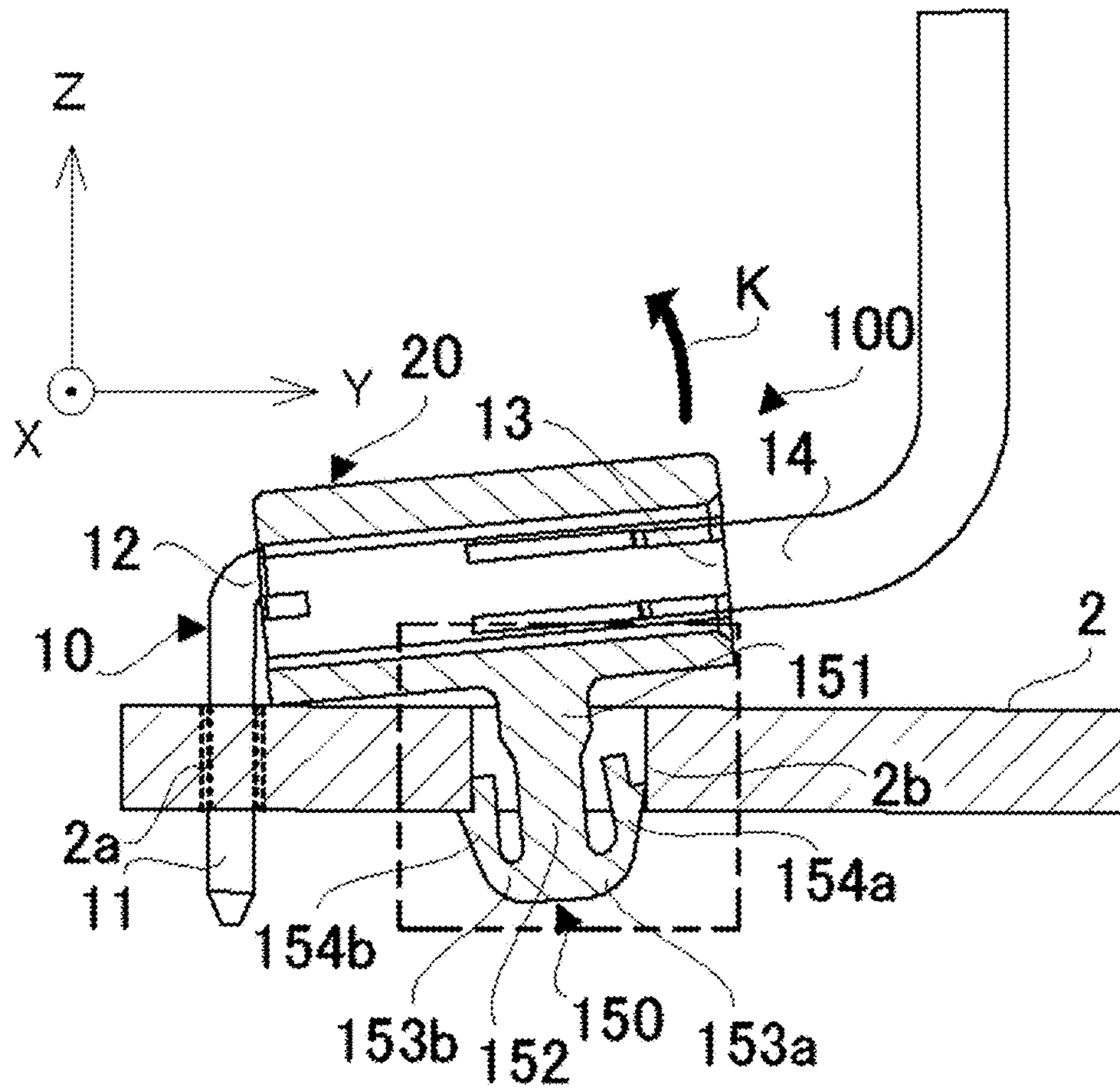


FIG. 9A2

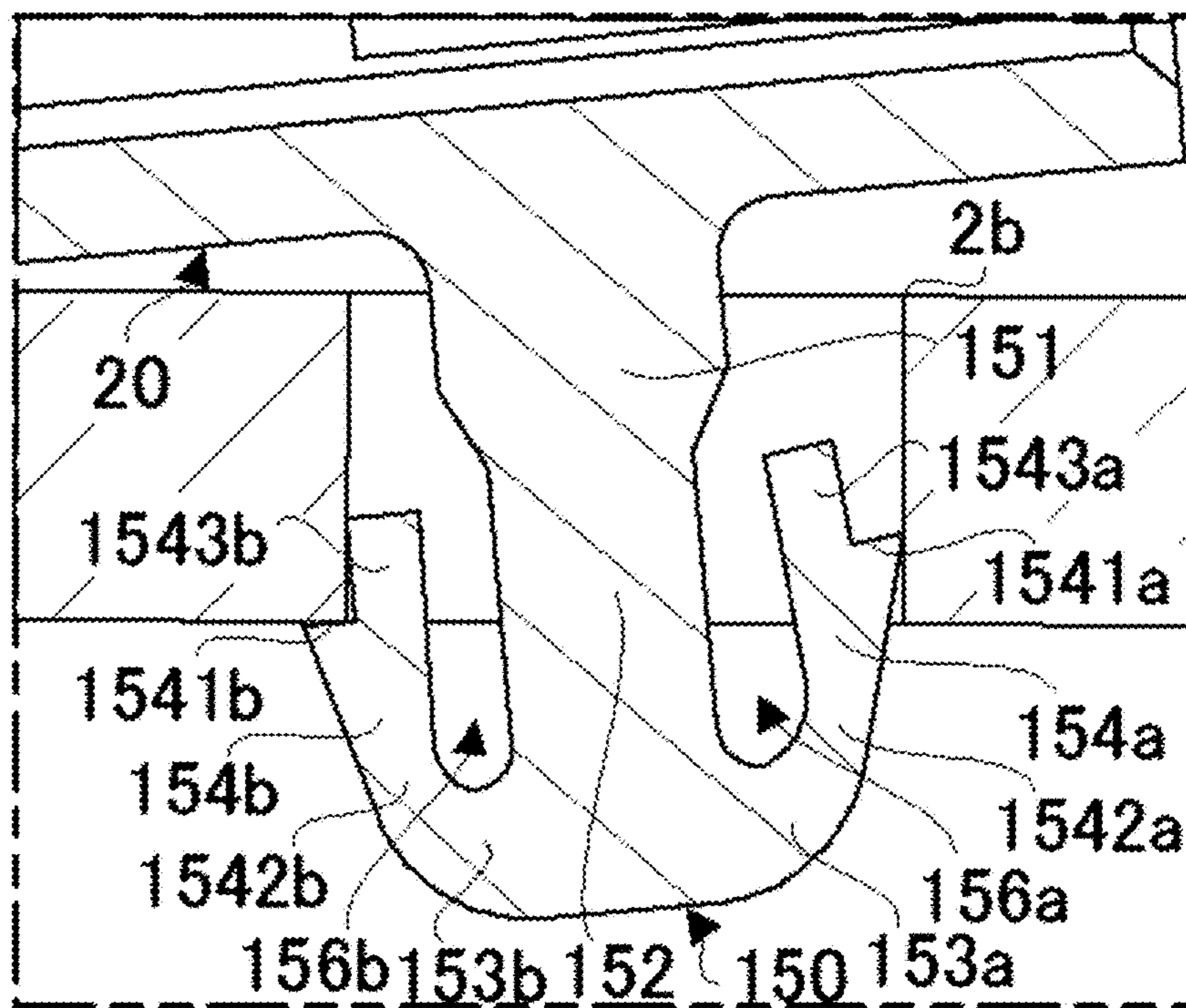


FIG.9B1

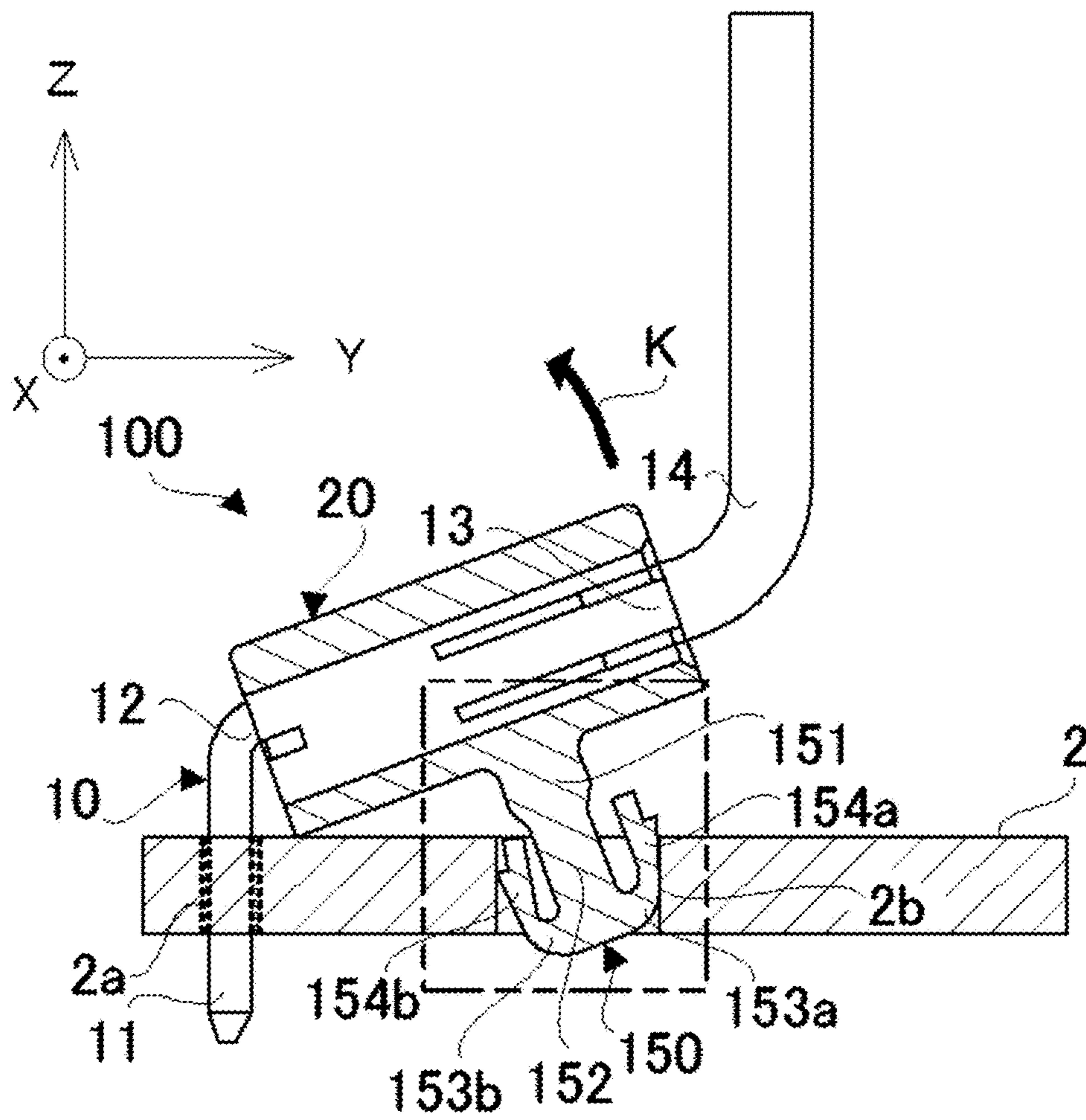
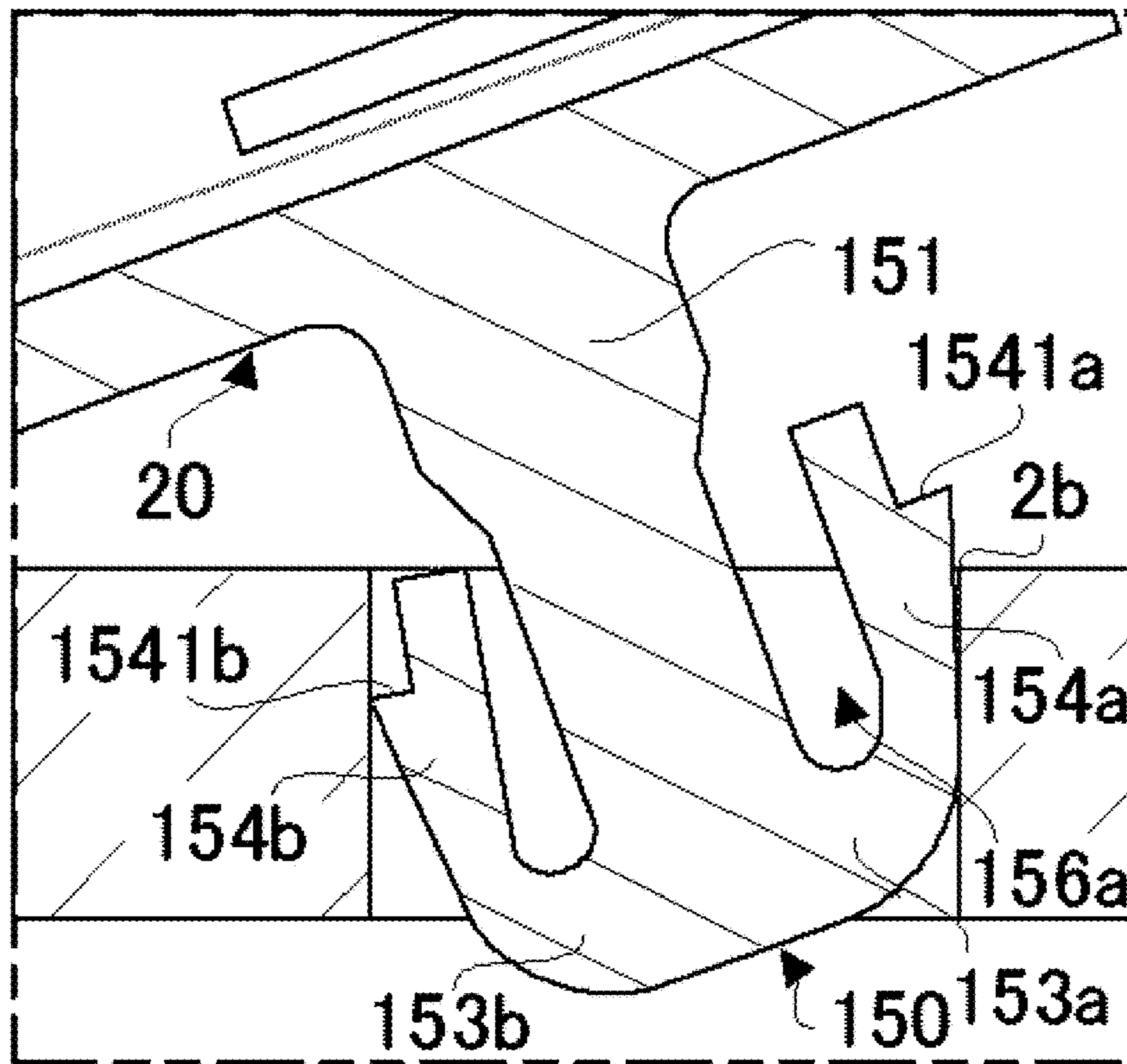


FIG. 9B2



# 1

## BOARD CONNECTOR

### CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of Japanese Patent Application No. 2016-212035, filed on Oct. 28, 2016, the entire disclosure of which is incorporated by reference herein.

### FIELD

This application relates to a board connector.

### BACKGROUND

In one known technique for mounting a connector on a board, the housing is equipped with a projection that has a retaining engagement claw being opposed to a pin's dip part, and the retaining engagement claw is engaged with the other main surface of the board by inserting the projection into a through hole intended for the projection (see Patent Literature 1, for example).

One known technique for fastening a connector to another member employs a clip that has a pair of resilient engagement pieces at its end (see the clip in Patent Literature 2, for example). In this technique, the clip is inserted into a through hole to cause the pair of resilient engagement pieces to be engaged with an edge of the through hole.

Patent Literature 1 Unexamined Japanese Patent Application Kokai Publication No. 2000-67959

Patent Literature 2 Japanese Patent No. 3185668

### SUMMARY

In the board connector described in Patent Literature 1, the retaining engagement claw is opposed to the dip part of a pin. Thus, the board connector involves a problem that, when a great upward force is acted on an end of the connector through, for example, operation of the cable, the housing is pulled toward the cable because the housing rotates around the point of support at which the pin is fastened to the board, the retaining engagement claw is less engaged with the board, and then the retaining engagement claw is released and disengaged from the board.

The connector described in Patent Literature 2 exerts the anchoring (attaching) effect when the pair of resilient engagement pieces are engaged with the board at two positions. However, the connector involves a problem that, when one of the pair of resilient engagement pieces is detached from the object to which the connector is attached, the other piece will also be disengaged.

As seen above, conventional connectors have a problem that the connector is prone to be detached from the object attached thereto, such as a board.

The present disclosure has been made in view of the foregoing circumstances, and an objective of the disclosure is to provide a board connector that is not prone to be detached from the board.

To achieve the aforementioned objective, a board connector according to the present disclosure is for attachment to a board that includes a first through hole and a second through hole, the board connector including:

an L-shaped pin terminal including an insertion inserted into the first through hole and a connecting part extending in a direction orthogonal to the insertion;

# 2

a housing disposed on one main surface of the board, the housing containing at least an end of the connecting part and having an opening into which a cable connected to the connecting part is inserted; and

a J-shaped boss formed integrally with the housing, the boss passing through the second through hole and protruding from an other main surface of the board, extending in an opposite direction with respect to a direction toward the insertion, and further extending toward the board.

The boss may include:

a base contiguous to the housing and inserted into the second through hole;

a protrusion contiguous to the base and protruding from the other main surface of the board;

an inversion contiguous to the protrusion, the inversion extending in the opposite direction and being inverted toward the board; and

an end contiguous to the inversion and extending toward the board,

wherein a space may be formed between the protrusion and the end.

The end may be formed such that a thickness of the end in the opposite direction decreases as the end is closer to the inversion.

The boss may be disposed at an end of the housing on a side of a direction in which the connecting part extends.

A plurality of the pin terminals may be disposed to be spaced apart from one another along a direction that is orthogonal to the insertion and is orthogonal to the connecting part, and

a plurality of the bosses may be disposed to be spaced apart from one another along a direction along which the pin terminals are disposed.

Owing to the above-described configurations, the board connector according to the present disclosure is not prone to be detached from a board.

### BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of this application can be obtained when the following detailed description is considered in conjunction with the following drawings, in which:

FIG. 1 is a perspective view of a board connector according to an embodiment of the present disclosure;

FIG. 2 is an exploded perspective view of the board connector in FIG. 1;

FIG. 3 is a perspective view of the board connector in FIG. 1 seen from the underside;

FIG. 4 is a perspective view of a housing;

FIG. 5 is a side view of the board connector in FIG. 1;

FIG. 6A is a diagram intended to explain attaching the board connector to a board;

FIG. 6B is a diagram intended to explain attaching the board connector to a board;

FIG. 6C is a diagram intended to explain attaching the board connector to a board;

FIG. 6D is a diagram intended to explain attaching the board connector to a board;

FIG. 7A1 illustrates the state in which the board connector is attached to a board;

FIG. 7A2 is an enlarged view of the boss in FIG. 7A1;

FIG. 7B1 illustrates the state in which the end of the boss is engaged with the board;

FIG. 7B2 is an enlarged view of the boss in FIG. 7B1;



FIG. 8A1 illustrates the state in which a board connector that includes a boss with a pair of resilient engagement pieces according to a comparative example is attached to a board;

FIG. 8A2 is an enlarged view of the boss in FIG. 8A1;

FIG. 8B1 illustrates the state in which the boss according to the comparative example becomes disengaged;

FIG. 8B2 is an enlarged view of the boss in FIG. 8B1;

FIG. 9A1 illustrates the state in which the boss according to the comparative example becomes disengaged;

FIG. 9A2 is an enlarged view of the boss in FIG. 9A1;

FIG. 9B1 illustrates the state in which the boss according to the comparative example becomes disengaged; and

FIG. 9B2 is an enlarged view of the boss in FIG. 9B1.

#### DETAILED DESCRIPTION

A board connector 1 according to an embodiment of the present disclosure will now be described with reference to FIGS. 1 to 7. For ease of understanding, an XYZ orthogonal coordinate system is applied to the drawings and referred to as appropriate, where the -Z-axis direction corresponds to the direction in which an insertion 11 of a below-described pin terminal 10 extends, while the +Y-axis direction corresponds to the direction in which a conductor swaging part 12 of the pin terminal 10 extends.

As illustrated in FIG. 1, the board connector 1 is mounted on one main surface (the surface on the +Z side) of a printed board 2 placed on an XY plane. The board connector 1 includes a pin terminal 10, a housing 20, and a boss 50.

As seen in FIG. 2, the pin terminal 10 is formed by bending a conductor, such as an electrically conductive plate material made from copper, aluminum, or the like. As illustrated in FIG. 2, the pin terminal 10, which is formed into an L shape, includes the insertion 11 extending in the -Z-axis direction and the conductor swaging part (connecting part) 12 extending in the +Y-axis direction. The conductor swaging part 12 of the pin terminal 10 is electrically connected, via an insulator swaging part 13, to a core wire conductor of a cable 14.

The insulator swaging part 13, which is formed of a member integral with the pin terminal 10, is coupled to the insertion 11 via the conductor swaging part 12 of the pin terminal 10. The insulator swaging part 13 is also coupled to an end of the cable 14, the end being an exposed core wire conductor with its insulator removed. As a result, the pin terminal 10 is fastened and electrically connected to the core wire conductor of the cable 14.

The housing 20 is formed from a polymeric resin, which is an insulating material, into a rectangular cuboid, and houses and protects the pin terminal 10, the insulator swaging part 13, and an end of the cable 14. The housing 20 includes a top plate 21, two side walls 22 and 23, and two partition walls 24 and 25. The side wall 22 is disposed lateral to the top plate 21 on the side of the -X-axis direction. The side wall 23 is disposed lateral to the top plate 21 on the side of the +X-axis direction. The two partition walls 24 and 25 are placed between the two side walls 22 and 23 to divide the space between the two side walls 22 and 23 into three regions in the X-axis direction.

In addition, as illustrated in FIG. 3, the housing 20 includes a bottom plate 26 extending from the bottom (the end on the side of the -Z-axis direction) of the side wall 22 in the +X-axis direction, a bottom plate 27 extending from the bottom of the partition wall 24 in the +X-axis direction, and a bottom plate 28 extending from the bottom of the partition wall 25 in the +X-axis direction. A slit 29 is formed

in each of the spaces between the bottom plate 26 and the partition wall 24, the bottom plate 27 and the partition wall 25, and the bottom plate 28 and the side wall 23. The slit 29 is wide enough for the insertion 11 of the pin terminal 10 to pass through during assembly, but is not wide enough for the conductor swaging part 12 to pass through.

As illustrated in FIG. 4, a housing region 30 is formed in each of the following regions: the region enclosed with the top plate 21, the side wall 22, the bottom plate 26, and the partition wall 24, the region enclosed with the top plate 21, the partition wall 24, the bottom plate 27, and the partition wall 25, and the region enclosed with the top plate 21, the partition wall 25, the bottom plate 28, and the side wall 23. Each housing region 30 contains the insulator swaging part 13, an end of the cable 14, and an end of the conductor swaging part 12. The housing 20 includes, at its end on the side of the +Y-axis direction, an opening 31 leading to the housing region 30.

As illustrated in FIG. 2, the housing 20 includes, at its end on the side of the -Y-axis direction, a stopper 35, a lance 36, and a stopper 37, which are used for retaining the conductor swaging part 12 and the insulator swaging part 13 of the pin terminal 10 within the housing region 30. The stopper 35 is formed integrally with the top plate 21, and protrudes in the -Z-axis direction. The stopper 35 serves as a stopper when the pin terminal 10 is inserted into the housing 20. The lance 36 is formed integrally with the side wall 22 or the partition wall 24 or 25, and extends in the +Y-axis direction. The lance 36 retains the pin terminal 10 with a pressing force by pressing the pin terminal 10 that has been inserted into the housing 20, so that the pin terminal 10 is prevented from coming off the housing 20. The stopper 37 is formed integrally with the bottom plate 26, 27, or 28, and protrudes in the +Z-axis direction. Along with the stopper 35, the stopper 37 serves as a stopper when the pin terminal 10 is inserted into the housing 20. As illustrated in FIG. 2, the pin terminal 10, the insulator swaging part 13, and the cable 14, which are linked together, are inserted into the opening 31 in the housing 20 (see FIG. 4). In this step, the insertion 11 of the pin terminal 10 is passed through the slit 29, and at the same time the insulator swaging part 13 is inserted into the housing region 30 (see FIG. 3). The conductor swaging part 12 is retained by the lance 36. Then, as depicted in FIG. 3, the insulator swaging part 13, an end of the cable 14, and an end of the conductor swaging part 12 are housed within the housing region 30. When every housing region 30 contains the insulator swaging part 13, three pin terminals 10 are now arranged to be spaced apart from one another along the X-axis direction, which is orthogonal to the insertion 11 and to the conductor swaging part 12.

As illustrated in FIGS. 3 and 4, a boss 50, which is formed integrally with the housing 20, is placed at an end of the housing 20 on the side of the +Y-axis direction. Two bosses 50 are arranged to be spaced apart from one another along the X-axis direction. As depicted in FIG. 5, the boss 50 is formed into a J shape and includes a base 51, a protrusion 52, an inversion 53, and an end 54.

The base 51 is contiguous to the bottom plate 26 or 28 of the housing 20 and extends in the -Z-axis direction. The protrusion 52 is contiguous to the base 51 and extends in the -Z-axis direction. The base 51 and the protrusion 52 are formed so that their lateral faces on the side of the -Y-axis direction are flush with each other. The protrusion 52 is made smaller than the base 51 in the dimension in the +Y-axis direction, creating a step 55 between the lateral faces of the base 51 and protrusion 52 on the side of the +Y-axis direction.

## 5

The inversion **53** is contiguous to the protrusion **52**, extends in a direction **D2** opposite to the direction **D1** toward the insertion **11**, and is inverted toward the +Z-axis direction. Note that the direction **D1** is the same as the -Y direction while the opposite direction **D2** is the same as the +Y direction. The end **54** is contiguous to the inversion **53** and extends in the +Z-axis direction. A space **56** is formed between the protrusion **52** and the end **54**. The inversion **53** and the end **54** are formed to protrude in the +Y-axis direction relative to the lateral face of the housing **20** on the side of the +Y-axis direction.

The end **54** includes a flat face **541** orthogonal to the Z axis. The flat face **541** is formed so that the distance **L** between the flat face **541** and the step **55** of the base **51** is slightly smaller than the thickness of the printed board **2**. This brings an advantage that, for example, when the board connector **1** is mounted on the printed board **2**, the base **51** is smoothly inserted into the through hole **2b** in the printed board **2** (see FIG. 1) without any part of the printed board **2** caught between the flat face **541** and the step **55** of the base **51**.

In addition, the flat face **541** is disposed so that the distance **L'** between the flat face **541** and the bottom plate **26**, **27**, or **28** (the face on the -Z side) of the housing **20**, that is, the distance **L'** between the flat face **541** and the bottom face of the printed board **2**, is slightly larger than the thickness of the printed board **2**.

A portion of the end **54** adjacent to the inversion **53** forms a resilient deforming part **542**, which can resiliently deform. The end **54** is formed so that its thickness in the +Y-axis direction decreases as the end **54** extends in the -Z-axis direction, or in other words, as the end **54** is closer to the inversion **53**. The lateral face of the end **54** on the side of the +Y-axis direction is sloped toward the -Y-axis direction as the end **54** extends in the -Z-axis direction. Thus, when the boss **50** is inserted into the through hole **2b** in the printed board **2**, the end **54** can lean in a direction closer to the protrusion **52** (the -Y-axis direction) starting from around the resilient deforming part **542**.

As illustrated in FIG. 1, the printed board **2** includes a through hole (first through hole) **2a** and a through hole (second through hole) **2b**. The through hole **2a**, into which the insertion **11** of the pin terminal **10** is to be inserted, has a diameter that allows the insertion **11** of the pin terminal **10** to be inserted. A conductor pattern **2c** is formed on the perimeter of the through hole **2a**. Three through holes **2a** are arranged along the X-axis direction with the same pitches as those for the pin terminals **10** so that the insertions **11** of all the pin terminals **10** can be inserted.

The through hole **2b**, into which the boss **50** is to be inserted, has a diameter slightly larger than the base **51** of the boss **50** allowing the base **51** to be inserted. Two through holes **2b** are arranged along the X-axis direction, spaced apart by the same distance as that between bosses **50**.

The distance along the Y-axis direction between the centers of the through holes **2a** and **2b** is approximately the same as the distance along the Y-axis direction between the centers of the insertion **11** of the pin terminal **10** and the boss **50**.

How the board connector **1** is attached to the printed board **2** will now be described.

In the first place, as illustrated in FIG. 2, the conductor swaging part **12** of the pin terminal **10** is connected to an end of the conductor of the cable **14** through the insulator swaging part **13**. Next, the cable **14** with the pin terminal **10** placed in front is inserted into the opening **31** in the housing **20** (see FIG. 4). In this step, the insertion **11** of the pin

## 6

terminal **10** is passed through the slit **29**, and at the same time the insulator swaging part **13** is inserted into the housing region **30**. When completely inserted, the conductor swaging part **12** is retained by the lance **36**, and, as depicted in FIG. 3, the insulator swaging part **13**, an end of the cable **14**, and an end of the conductor swaging part **12** are housed within the housing region **30**.

Next, as illustrated in FIG. 6A, the insertion **11** of the pin terminal **10** is inserted into the through hole **2a** in the printed board **2**, while the boss **50** is inserted into the through hole **2b** in the printed board **2**. During this step, as illustrated in FIG. 6B, the end **54** of the boss **50** comes to abut on an edge of the through hole **2b**. It should be noted that the end **54** includes the resilient deforming part **542**, and there is a space **56** between the protrusion **52** and the end **54**. Thus, the end **54** leans in a direction closer to the protrusion **52** as seen in FIG. 6C. Then, when the end **54** comes out of the through hole **2b**, the end **54** returns to its original posture as depicted in FIG. 6D.

Subsequently, the insertion **11** and the conductor pattern **2c** formed on the perimeter of the through hole **2a** are soldered, and the insertion **11** of the pin terminal **10** is connected to a circuit formed on the printed board **2**.

The board connector **1** in this state, which is illustrated in FIGS. 7A1 and 7A2, is fastened to the printed board **2** with the soldered insertion **11** and the boss **50**.

At this point of time, if a force is acted in the +Z-axis direction on an end of the housing **20** on the side of the +Y-axis direction due to, for example, lifting up the cable **14**, the housing **20** rotates in the direction indicated by an arrow **K** in FIG. 7B1 around the point at which the pin terminal **10** is fastened to the printed board **2** or the point at which the pin terminal **10** is bent, the point serving as a point of support. Then, as illustrated in FIGS. 7B1 and 7B2, the flat face **541** of the end **54** abuts on the other main surface of the printed board **2**, and the boss **50** is retained on the other main surface of the printed board **2**. As a result, the housing **20** stops rotating. If a force is further acted on the housing **20** in the +Z-axis direction, the rotation of the housing **20** is restricted because the end **54** abuts on the printed board **2**. At this point of time, a force is acted on the end **54** of the boss **50** in the +Y-axis direction. Even when the end **54** moves in the +Y-axis direction caused by the force acted in the +Y-axis direction, the end **54** is not detached from the printed board **2**.

Therefore, the board connector **1** is not detached from the printed board **2** irrespective of a force applied to the board connector **1** in the +Z-axis direction.

For the purpose of making a comparison with the board connector **1** according to the present embodiment, the following describes a comparative example referring to FIGS. 8 and 9, in which a board connector **100** is equipped with a boss that includes a pair of resilient engagement pieces like the boss described in Patent Literature 2. For ease of understanding, an XYZ orthogonal coordinate system is applied to the drawings and referred to as appropriate, as in FIGS. 1 to 7. Note that the board connector **100** includes a pin terminal **10** and a housing **20** that are configured in the same manner as in the board connector **1**.

As illustrated in FIGS. 8A1 and 8A2, the board connector **100** is equipped with a boss **150** that includes a pair of resilient engagement pieces. The boss **150** is formed integrally with the housing **20** and is placed at a center of the housing **20** with respect to the Y-axis direction. As depicted in FIG. 8A2, the boss **150** includes a base **151**, a protrusion **152**, inversions **153a** and **153b**, and ends **154a** and **154b**.

The inversion **153a** and the end **154a** with the inversion **153b** and the end **154b** together form a pair of resilient engagement pieces.

The base **151** is contiguous to the bottom plate **26** or **28** of the housing **20** and extends in the  $-Z$ -axis direction. The protrusion **152** is contiguous to the base **151** and extends in the  $-Z$ -axis direction. The dimension of the protrusion **152** along the Y-axis direction is made smaller than the dimension of the base **151** along the Y-axis direction, and thus a step **155a** is formed between the lateral faces of the base **151** and the protrusion **152** on the side of the  $+Y$ -axis direction, while a step **155b** is created between the lateral faces of the base **151** and the protrusion **152** on the side of the  $-Y$ -axis direction.

The inversion **153a** is contiguous to the protrusion **152**, extends in the  $+Y$ -axis direction, and is inverted toward the  $+Z$ -axis direction. The end **154a** is contiguous to the inversion **153a** and extends in the  $+Z$ -axis direction. A space **156a** is formed between the protrusion **152** and the end **154a**. The inversion **153b** is contiguous to the protrusion **152**, extends in the  $-Y$ -axis direction, and is inverted toward to the  $+Z$ -axis direction. The end **154b** is contiguous to the inversion **153b** and extends in the  $+Z$ -axis direction. A space **156b** is formed between the protrusion **152** and the end **154b**.

The ends **154a** and **154b** include flat faces **1541a** and **1541b**, respectively, orthogonal to the Z-axis (and parallel to an XY plane). Each of the ends **154a** and **154b** is formed so that its thickness in the  $+Y$ -axis direction decreases as the end extends in the  $-Z$ -axis direction, or in other words, as the end is closer to the inversion **153a** or **153b**. Portions of the ends **154a** and **154b** adjacent to the inversions **153a** and **153b** form resilient deforming parts **1542a** and **1542b**, respectively, which can resiliently deform. Thus, the end **154a** can lean in a direction closer to the protrusion **152** (the  $-Y$ -axis direction) starting from around the resilient deforming part **1542a**. Likewise, when the boss **150** is inserted into the through hole **2b** in the printed board **2**, the end **154b** can lean in a direction closer to the protrusion **152** (the  $+Y$ -axis direction) starting from around the resilient deforming part **1542b**.

In addition, the ends **154a** and **154b** include restricting parts **1543a** and **1543b** extending from the flat faces **1541a** and **1541b**, respectively, in the  $+Z$ -axis direction. When the restricting part **1543a** abuts on an inner wall of the through hole **2b**, the movement of the end **154a** in the  $+Y$ -axis direction is restricted. Likewise, when the restricting part **1543b** abuts on an inner wall of the through hole **2b**, the movement of the end **154b** in the  $-Y$ -axis direction is restricted.

As illustrated in FIGS. **8A1** and **8A2**, when the board connector **100** has been mounted on the printed board **2**, the base **151** of the boss **150** is inserted into the through hole **2b** while the ends **154a** and **154b** extend toward the printed board **2**.

When a force is acted in the  $+Z$ -axis direction on an end of the housing **20** on the side of the  $+Y$ -axis direction due to, for example, lifting up the cable **14**, the housing **20** rotates in the direction indicated by the arrow **K** in FIG. **8B1**. Subsequently, the flat faces **1541a** and **1541b** of the ends **154a** and **154b** abut on the flat face of the printed board **2** on the  $-Z$  side, which causes the boss **150** to be engaged with the printed board **2**, and then the housing **20** and the boss **150** stop rotating.

When a force is further acted on the housing **20** in the  $+Z$ -axis direction, the restricting part **1543b** abuts on an inner wall of the through hole **2b**, and the movement of the end **154b** in the  $-Y$ -axis direction is restricted, and at the

same time the protrusion **152** comes closer to the end **154b**. As the protrusion **152** comes closer to the end **154b**, the end **154a** moves in the  $-Y$ -axis direction, and the end **154a** is released from the printed board **2** as illustrated in FIG. **8B2**.

Then, the housing **20** rotates in the direction indicated by the arrow **K** in FIG. **9A1**, the flat face **1541b** of the end **154b** of the boss **150** is tilted as seen in FIG. **9A2**, and the end **154b** is displaced in the  $+Y$ -axis direction and becomes released from the printed board **2** as shown in FIGS. **9B1** and **9B2**.

As seen above, in the board connector **100** equipped with the boss **150** according to the comparative example, once the end **154a** is released from the printed board **2**, the end **154b** also becomes released from the printed board **2**, causing the boss **150** to be disengaged from the printed board **2**.

In addition, as described above, the boss **150** is placed at a center of the housing **20** with respect to the Y-axis direction. Thus, when the cable **14** is lifted up, an end of the housing **20** on the side of the  $+Y$ -axis direction serves as a point of effort, while a portion in which the pin terminal **10** is fastened to the printed board **2** or in which the pin terminal is bent serves as a point of support, and the base of the boss **150** serves as a point of application. Hence, a force greater than that acted on the end of the housing **20** on the side of the  $+Y$ -axis direction is applied to the boss **150**. Therefore, even when a small force is acted on the housing **20**, the ends **154a** and **154b** may be released from the printed board **2**, causing the boss **150** to be disengaged from the printed board **2**.

Accordingly, it is again understood that the board connector **1** of the present embodiment is not prone to be detached from the printed board **2**.

As described above, the board connector **1** according to the present embodiment includes: the pin terminal **10** that is formed into an L shape and includes the insertion **11** to be inserted into the through hole **2a** in the printed board **2** and the conductor swaging part **12** extending in a direction ( $+Y$ -axis direction) orthogonal to the insertion **11**; and the housing **20** that includes the opening **31** which houses at least an end of the conductor swaging part **12** and into which the cable **14** connected to the conductor swaging part **12** is inserted, wherein the housing **20** is to be placed on one main surface of the printed board **2**. The board connector **1** further includes the boss **50** that is in a J shape and is formed integrally with the housing **20**, the boss **50** passing through the through hole **2b** in the printed board **2** and protruding from the other main surface of the printed board **2**, extending in the direction **D2** ( $+Y$ -axis direction) opposite to the direction **D1** toward the insertion **11**, and further extending toward the printed board **2**. As a result, the boss **50** is prevented from being disengaged from the printed board **2** when a force is acted on the housing **20** in the  $+Z$ -axis direction caused by, for example, operating or vibrating the cable **14** by accident.

In the board connector **1** according to an embodiment of the present disclosure, the boss **50** includes: the base **51** that is contiguous to the housing **20** and is inserted into the through hole **2b** in the printed board **2**; the protrusion **52** that is contiguous to the base **51** and protrudes from the other main surface of the printed board **2**, the inversion **53** that is contiguous to the protrusion **52**, extends in the direction **D2** ( $+Y$ -axis direction) opposite to the direction **D1** toward the insertion **11**, and is inverted toward the printed board **2**; and the end **54** that is contiguous to the inversion **53** and extends toward the printed board **2**. The space **56** is formed between the protrusion **52** and the end **54**. As a result, when a force is acted on the housing **20** in the  $+Z$ -axis direction, the end

**54** abuts on the other main surface of the printed board **2**, and thus the boss **50** is prevented from being disengaged from the printed board **2**.

In the board connector **1** according to an embodiment of the present disclosure, the end **54** is formed so that its thickness in the direction **D2** (+Y-axis direction) opposite to the direction **D1** toward the insertion **11** decreases as the end **54** is closer to the inversion **53**. Thus, a portion of the end **54** adjacent to the inversion **53** forms the resilient deforming part **542**. As a result, when the boss **50** is inserted into the through hole **2b** in the printed board **2**, the end **54** leans in a direction closer to the protrusion **52**, without creating an obstruction for the boss **50** to be inserted into the through hole **2b** in the printed board **2**.

In the board connector **1** according to an embodiment of the present disclosure, the boss **50** is placed at an end of the housing **20** on the side of the direction **D2** (+Y-axis direction) opposite to the direction **D1** toward the insertion **11**. As a result, when a force is acted in the +Z-axis direction on an end of the housing **20** on the side of the +Y-axis direction, any greater force is prevented from acting on the boss **50**.

In the board connector **1** according to an embodiment of the present disclosure, pin terminals **10** are arranged to be spaced apart from one another along a direction (the X-axis direction) orthogonal to insertions **11** and to conductor swaging parts **12**. Bosses **50** are arranged to be spaced apart from one another along the direction (the X-axis direction) in which the pin terminals **10** are arranged. As a result, irrespective of whether the housing **20** is formed into a rectangular cuboid whose size along the X-axis direction is larger than its size along the Y-axis direction, the bosses **50** are prevented from being disengaged from the printed board **2**.

Embodiments of the present disclosure have been described above, but the present disclosure is not limited to the foregoing embodiments.

In the foregoing embodiments, the pin terminal **10** is L-shaped including the insertion **11** and the conductor swaging part **12**. However, the pin terminal **10** may be configured in any way as long as the cable **14** can be connected to a circuit pattern on the board.

In the foregoing embodiments, the pin terminal **10** and the insulator swaging part **13** are described as being integrated with each other into a connecting terminal having a pin. However, the present disclosure is not limited to this. For example, the pin terminal **10** and the insulator swaging part **13** may be different members.

In the foregoing embodiments, the pin terminal **10**, the insulator swaging part **13**, and the cable **14** are linked together, and the cable **14** with the pin terminal **10** placed in front is inserted into the opening **31** in the housing **20**. However, the present disclosure is not limited to this configuration. For example, the housing **20** may include a side wall on a lateral part of the top plate **21** on the side of the -Y-axis direction, and the conductor swaging part **12** of the pin terminal **10** may be passed through and retained on the side wall. Then, the cable **14** coupled to a connecting terminal, which is to be fitted to the conductor swaging part **12**, may be inserted into the opening **31**, and the connecting terminal may be fitted to the conductor swaging part **12**, so that electrical connection is established between the pin terminal **10** and a core wire conductor of the cable **14**.

The housing **20** may be configured in any way as long as the housing **20** can house and support a connection among the pin terminal **10**, the insulator swaging part **13**, and the cable **14**.

In the foregoing embodiments, the boss **50** includes the base **51**, the protrusion **52**, the inversion **53**, and the end **54** as illustrated in FIG. **5**. However, the present disclosure is not limited to this configuration. The boss **50** need only form a J shape passing through the through hole **2b**, protruding from the other main surface of the printed board **2**, extending in a direction (+Y-axis direction) opposite to the direction toward the insertion **11**, and further extending toward the printed board **2**. For example, the boss **50** may extend in the -Z-axis direction, and then bend at a right angle toward the +Y-axis direction to extend in the +Y-axis direction, and further bend at a right angle toward the +Z-axis direction to extend in the +Z-axis direction. Such shape of the boss **50** is also referred to as J-shaped.

The foregoing example shows that the end **54** includes the flat face **541** parallel to an XY plane. However, the flat face may be in any shape as long as it can be engaged with the printed board **2** when subjected to an external force. For example, the flat face **541** may not necessarily be parallel to an XY plane. Alternatively, the end **54** may include a non-flat face instead of the flat face **541**.

In the foregoing embodiments, three pin terminals **10** are arranged along the X-axis direction while two bosses **50** are arranged along the X-axis direction. However, the present disclosure is not limited to these numbers, and any number of pin terminals **10** and any number of bosses **50** may be arranged. For example, the number of pin terminals **10** may be two or four or more while the number of bosses **50** may be three or more. The number of pin terminals **10** may or may not be the same as the number of bosses **50**. Only one pin terminal **10** and only one boss **50** may be disposed. Alternatively, a plurality of pin terminals **10** and one boss **50** may be disposed, or one pin terminal **10** and a plurality of bosses **50** may be disposed.

Furthermore, the above-described materials, shapes, and sizes are example only, and are not meant to be restrictive.

The foregoing describes some example embodiments for explanatory purposes. Although the foregoing discussion has presented specific embodiments, persons skilled in the art will recognize that changes may be made in form and detail without departing from the broader spirit and scope of the invention. Accordingly, the specification and drawings are to be regarded in an illustrative rather than a restrictive sense. This detailed description, therefore, is not to be taken in a limiting sense, and the scope of the invention is defined only by the included claims, along with the full range of equivalents to which such claims are entitled.

What is claimed is:

**1.** A board connector for attachment to a board that includes a first through hole and a second through hole, the board connector comprising:

an L-shaped pin terminal comprising an insertion inserted into the first through hole and a connecting part extending in a direction orthogonal to the insertion;

a housing disposed on one main surface of the board, the housing containing at least an end of the connecting part and having an opening into which a cable connected to the connecting part is inserted; and

a J-shaped boss formed integrally with the housing, the boss passing through the second through hole and protruding from an other main surface of the board, extending from an end of the housing that is apart from the pin terminal and in a direction opposite to the direction toward the insertion, and further extending toward the board wherein

**11**

the boss comprises:

a base contiguous to the housing and inserted into the second through hole;

a protrusion contiguous to the base and protruding from the other main surface of the board;

an inversion contiguous to the protrusion, the inversion extending in the direction opposite to the direction toward the pin terminal and being inverted toward the board; and

an end contiguous to the inversion and extending toward the board,

a space is formed between the protrusion and the end, and the inversion and the end protrude from an end of the housing that is apart from the pin terminal and in a direction opposite to the direction toward the pin terminal (+Y direction).

2. The board connector according to claim 1, wherein the end is formed such that a thickness of the end in the opposite direction decreases as the end is closer to the inversion.

**12**

3. The board connector according to claim 1, wherein the boss is disposed at an end of the housing on a side of a direction in which the connecting part extends.

5 4. The board connector according to claim 1, wherein a plurality of the pin terminals are disposed to be spaced apart from one another along a direction that is orthogonal to the insertion and is orthogonal to the connecting part, and wherein a plurality of the bosses are disposed to be spaced apart from one another along a direction along which the pin terminals are disposed.

10 5. The board connector according to claim 1, wherein a cross-sectional area of the base is approximately equal to an area of the second through hole.

15 6. The board connector according to claim 1, wherein the boss is further configured to define a gap between the end and the board when the connector is fully inserted.

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